DFTView

Graphical Waveform Display and Validation

User Guide

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SOURCE III

Source III, Inc.

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1 OVERVIEW

1.1 Introduction

The DFTView® program allows the user to view and edit source files in a number of formats including WGL, STIL, Catalyst, SVF, Advantest T2000 and VCD/EVCD, or VTRAN®-generated Verigy 93000 or Teradyne J750 or FLEX formats, in a text editor window while viewing the waveforms represented by the source file timing and vectors in a Synopsys **nWave** or a **GTKWave** window. It provides the following capabilities:

- Directly view the waveforms that will be applied to a device on a tester as described in a WGL, STIL, Catalyst, SVF, Advantest T2000, VCD/EVCD file or a VTRAN®-generated Verigy 93000 or Teradyne J750 or FLEX test vector file.

- Waveform viewing of these files provides exact state as well as edge timing information for the test program in a very familiar and graphical format.

- Automatically check a source file for syntax errors, and validate by inspection a source file's contents prior to the test vectors being applied to a device on the tester.

- Edit the contents of the source file and see the exact effect on tester waveforms. This is a common situation for debug and SOC integration.

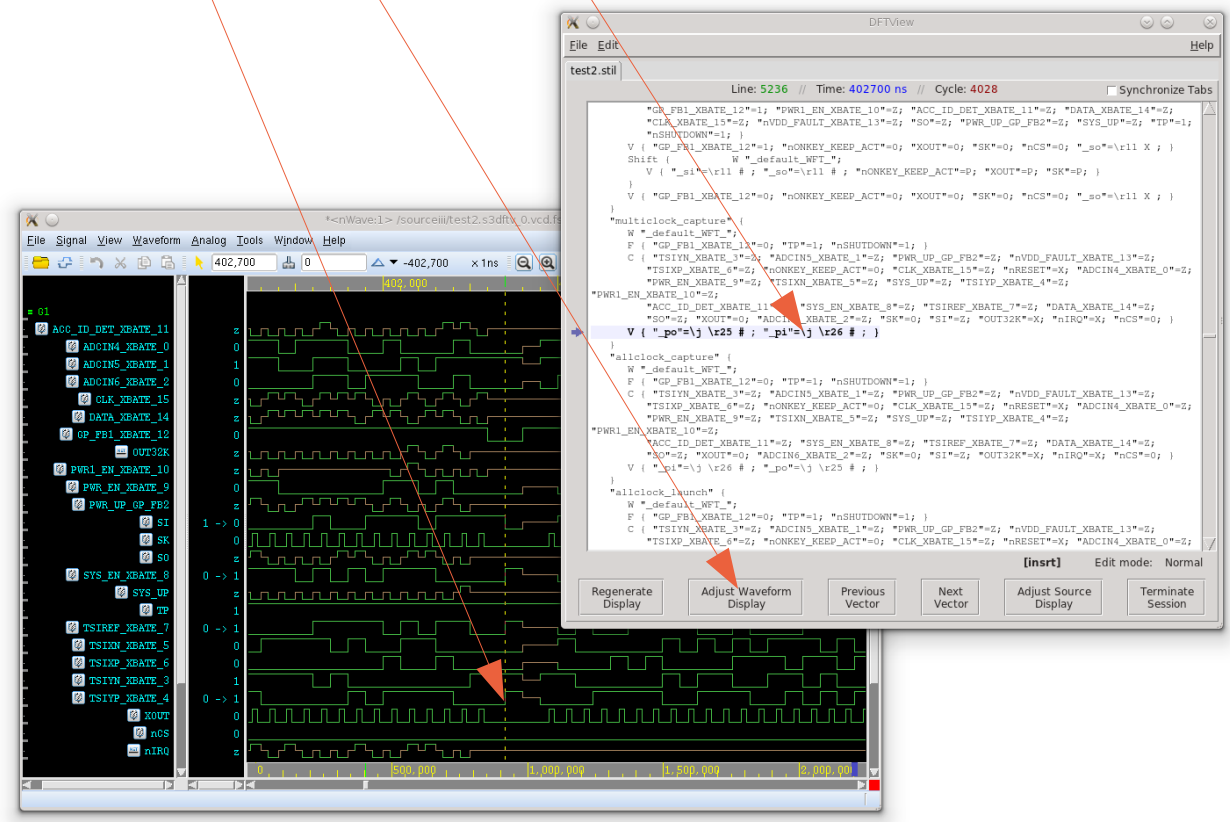
- Some testers directly accept STIL files as test programs so this allows the user to directly view and validate these test patterns.

- Select a vector line in the source file with your cursor, click the "Adjust Waveform Display" button and see the exact corresponding waveform location in the waveform display window. Or select a waveform position and click "Adjust Source Display" to see the corresponding source

vector line in the source display as shown here:

Source File to Waveform:

1. Place cursor on desired vector statement
2. Click “Adjust Waveform” button
3. Waveform cursor identifies location



- Display multiple source files/waveforms in multiple tabs; allow “locking” the cursor position on each tab to help compare specific time points in multiple files.

- Compare the waveforms of two disparate files types (for example STIL and VCD) to quickly identify differences in waveforms, such as when comparing input and output files from a vector translation (*e.g.* a VTRAN® translation)

1.2 System Requirements

1.2.1 Operating System

DFTView® binaries are available for 32-bit and 64-bit Linux with a 2.4.21 or higher kernel and should run on most Linux distributions released within the last 10 years. Some of the distributions (both 32-bit and 64-bit) we have successfully tested DFTView® on include:

- Fedora 14, Fedora 15, Fedora 16
- CentOS 3.8, CentOS 5.6
- openSUSE 12.3
- Ubuntu 10.04/10, Ubuntu 11.04/10, Ubuntu 12.04

DFTView® is also available for 32-bit and 64-bit Solaris (SPARC) 8 or higher, and has been tested on Solaris 8 and Solaris 10.

1.2.2 Hardware

DFTView® for Linux runs on Intel x86 (32-bit) and AMD64/EM64T (64-bit) processors. DFTView® for Solaris run on 32-bit and 64-bit SPARC processors.

DFTView® requires up to 200MB of memory for each tab you have open, and be aware that if you open large input files this requirement goes up accordingly. For example, on an AMD64 test system, when opening a single 163MB STIL file containing a lot of repeat vectors, DFTView® required at its peak 1.4GB of physical RAM. It also consumed over 4GB of storage (hard disk space) for intermediate (temporary) vector data.

The complete DFTView® package requires approximately 24MB of hard drive (storage) space to install. You should also factor in the memory and storage space requirements for your chosen waveform viewer (Section 2.4); consult the relevant documentation of each package to get more information.

Temporary files created during normal operation of DFTView® can be very large (depending on input file size, number of vectors and other considerations); a good rule of thumb is to ensure at least 30 times the (uncompressed) storage space required for an ATE file – for example you might need 3GB or more of space when opening a 100MB file (see example above).

DFTView® requires a display resolution of, at an absolute minimum, 1024×768 pixels (XGA). However for optimum results we recommend a display resolution of at least 1280×1024 pixels (SXGA).

1.3 Supported File Formats

DFTView® can read and display a number of file formats as shown below. The listed filename extensions are not mandatory, but are useful in helping DFTView® identify which format a given file contains.

File Format	Filename Extensions	Shorthand
Advantest T2000	.t2000, .pat	**t2000**
Catalyst	.cat, .catl, .catalyst	**catalyst**
EVCD (Enhanced Value Change Dump)	.evcd	**evcd**
HP 93000	.agk, .avc, .93k, .v93k, .hptab	**93k**
STIL (Standard Test Interface Language)	.stil	**stil**
SVF (Serial Vector Format)	.svf	**svf**
Teradyne FLEX (includes FLEX, iFLEX, microFLEX and ultraFLEX)	.flex, .tp, .atp	**flex**
Teradyne J750	.j750	**j750**
Teradyne J750+	.j750, .j750+	**j750+**
Texas Instruments TDL 91	.tdl, .tdl91, .tdl_91	**tdl_91**
Toshiba TSTL2	.tstl2	**tstl2**
VCD (Value Change Dump)	.vcd	**vcd**
WGL (Waveform Generation Language)	.wgl	**wgl**

Compressed input files will also likely have an additional '.gz' extension appended. DFTView® will auto-detect the correct format with or without this added extension.

If you wish to read a supported input file which has a different or custom extension you can tell DFTView® what the file format is by passing a `-FMT` or `--format=FMT` command-line argument, substituting *FMT* with the relevant shorthand format string above (see Section 3.1.1).

> ***Tip:*** *While DFTView® can view any WGL, STIL, EVCD or VCD file, for other ATE formats it can only read VTRAN-generated files.*

2 SETUP

2.1 DFTView® Install Script

As outlined below DFTView® can be installed manually without much trouble – most of the steps involve setting up your environment variables correctly. To facilitate this process we have included an installer script which will guide you through installation and setup. The script *installdftview.sh* can be run in two modes: the default "install mode" (Section 2.1.1) which will help you install DFTView®, and a "check mode" (Section 2.1.2) which will examine your current system and environment setup to make sure everything is in order for you to use DFTView®.

2.1.1 Install Mode

In this default mode simply invoke *installdftview.sh* without arguments, and it will present you with a short set of questions to help guide you through the installation process. Most questions will have a default answer you can accept by just hitting <Enter>. As the script runs it will prompt you for some information regarding your installation directory, preferred waveform viewer and so on. It will then install the required files for DFTView®, and then present you with a few lines to add to your `.profile` (bash, zsh users), `.tchsrc` or `cshrc` (tcsh, csh users) or other startup script, already customized for your installation. Even if you decide to leave the DFTView® package where you unpacked it, you should still run *installdftview.sh* and accept the default value for the installation directory, as this will still help you to configure your environment correctly.

During the installation process the script will check to see if you have a compatible waveform viewer already installed on your system – see "**Waveform Viewer Selection**" (Section 2.4). If no compatible viewer is detected, *installdftview.sh* will offer you the option to automatically download a GTKWave binary package directly from the Source III site and install it for you. This is an unmodified build of GTKWave version 3.3.46 which includes a complete Tcl/Tk runtime environment, and is compatible with most Linux systems. If for any reason the package cannot be downloaded automatically, you can download it yourself from the Source III FTP site and place it in the DFTView® "support" directory

(you don't have to uncompress or unpack it). The next time you run the installer it will automatically install GTKWave from this downloaded file.

When the installer has finished, it will display the environment variables you need to add to your shell login scripts (a set of each of C shell and Bourne shell lines will be displayed).

2.1.2 Check Mode

The *installdftview.sh* script also provides a “check mode” where it will examine your system and environment to determine if all the prerequisites for DFTView® are available. Simply run as follows:

```
./installdftview.sh -check
```

It will report back on required system components and important environment variables, with suggestions on what to do if anything appears amiss.

Running the installer in this check mode can be performed any time, and does not require that you installed DFTView® via *installdftview.sh* to begin with. This may be useful for example if you are a systems administrator and need to verify a custom environment setup script for your users.

2.2 Uninstalling DFTView®

We hate to see you go, but if you wish to completely uninstall DFTView® from your system there is no special command or procedure required. Simply delete the contents of the $DFTVIEW_ROOT directory, and optionally remove any environment configurations you set up as part of the installation. In addition you can delete the DFTView® preferences file which you'll find in a hidden “dot-directory” under your home directory:

```
~/.sourceiii/dftview.preferences
```

2.3 Manual Installation and Setup

The DFTView® program bundles are available for Solaris SPARC and Linux platforms. These can be downloaded from the Source III web site at:

http://www.sourceiii.com/support.php

Select the DOWNLOAD SOFTWARE tab. Once the bundle is downloaded, gunzip it and untar it into a directory. Then do the following:

1) Define an environment variable named DFTVIEW_ROOT which points to this directory. This is used by the application programs to find additional program modules. In order to set the DFTVIEW_ROOT environment variable, add the following command to your .cshrc and/or .login file:

```
setenv DFTVIEW_ROOT /path
```

where /path is the directory path into which this software was loaded. For example, if the tar file for the linux64 build was unpacked in the directory /usr/source3, then the following command could be used:

```
setenv DFTVIEW_ROOT /usr/source3/linux64
```

You then must either logout and log back in, or issue the following command from the console:

```
source ~/.cshrc
```

-or-

```
source ~/.login
```

NOTE: The instructions above are geared for a csh (C shell). Setup will vary slightly for different shells.

2) Add the /path to your search path so the DFTView® program and modules can be found. If you installed GTKWave from the Source III FTP site using the installer, you should also add $DFTVIEW_ROOT/support/ to the ***end*** of your path, *e.g.*:

```
setenv PATH ${PATH}:$DFTVIEW_ROOT/support
```

2.4 Waveform Viewer Selection

DFTView® can be run using either the Synopsys nWave/Verdi waveform display tool, or the open-source **GTKWave** waveform display tool. The waveform tool to be used is selected using an environment variable named DFTVIEW_DISPLAY. To select the GTKWave tool, use:

```
setenv DFTVIEW_DISPLAY GTKWave
```

-or-

```
export DFTVIEW_DISPLAY=GTKWave
```

For optimal performance with GTKWave, it is recommended that you use a recent release such as v3.3 or later. If GTKWave is already installed on your system you don't need to do anything else. If it doesn't appear to be installed (*e.g.* "which gtkwave" doesn't return a path to the gtkwave executable), you can install the package on Linux with the "yum" or "apt-get" commands as applicable, *e.g.*:

RedHat, CentOS, Fedora, etc.:	`sudo yum install gtkwave`
Ubuntu, Debian, etc:	`sudo apt-get install gtkwave`

We have also prepared Linux and Solaris-compatible GTKWave binary packages (release 3.3.21) which are freely available from our support FTP site. Installation is as simple as running the *installdftview.*sh script as described in "**DFTView® Install Script"** (Section 2.1) or downloading the relevant package compatible with your system, unpacking it and adding the path to the "gtkwave" command to your PATH. At this stage you can verify GTKWave is working just by typing the command "gtkwave".

To select the Synopsys nWave waveform display tool, use:

```
setenv DFTVIEW_DISPLAY nWave
```

-or-

```
export DFTVIEW_DISPLAY=nWave
```

If no DFTVIEW_DISPLAY environment variable is defined, then the Synopsys nWave tool is assumed. When the nWave tool is being used to display waveforms, by default, DFTView® launches nWave directly. However, for some customer environments it is necessary to launch Verdi first and then bring-up nWave from Verdi. In order to address this, an environment variable named DFTV_VERDI can be defined and set to a 1, which will cause Verdi to be launched prior to nWave. To activate this, use:

```
setenv DFTV_VERDI 1
```

-or-

```
export DFTV_VERDI=1
```

> ***Tip:*** *Users of older versions of DFTView® may notice that in the past, the waveform viewer would be launched immediately when DFTView® was run, even without arguments. With the tab-based viewing system which was first introduced in DFTView® 3, you will not see the waveform viewer application launch until an input file is opened.*

2.5 Licensing

The DFTView® program uses Flexera (FlexLM) licensing software. We support both floating and node-locked licenses for evaluation and purchase. Depending on the licensing model you choose, we will need some basic information from you so that we can provide you with the appropriate license.

2.5.1 Node Locked License

*Summary: Run **DFTView --hostid** on each target system where you wish to run DFTView®*

In the simplest case, we can issue you a node-locked license. This, as the name suggests, "locks" the execution of DFTView® to a specific system, or node. For this license all we need is the host ID which you can get by running DFTView® with a special command-line argument. Issue the command `DFTView --hostid` and send us the output which will look something like this (with a different host ID, of course):

```
DFTView Version 4.1.1 (C) 2014 Source III, Inc.
The FLEXnet host ID of this machine is "123456789abc"
```

If you wish to have several systems included in a node-locked license (thus allowing DFTView® to be run on more than one workstation) simply issue the same `DFTView --hostid` command on each system and send us the output from all of them.

Once this is done and we have issued you a license file, DFTView® will examine the license file every time it runs, and compare the host ID defined in that file with the current host ID (determined automatically at run time). DFTView® locates the license file by examining an environment variable named LM_LICENSE_FILE. Just set this environment variable to where-ever you install your license file, *e.g.*:

```
export LM_LICENSE_FILE=/foo/bar/sourceIII.lic          (bash, zsh)
```

```
setenv LM_LICENSE_FILE /foo/bar/sourceIII.lic          (csh, tcsh)
```

If you already have a LM_LICENSE_FILE environment variable defined just add the new license filename to the end, separated from the other entries with a colon, *e.g.*:

```
export LM_LICENSE_FILE=/foo/file1.lic:/foo/bar/sourceIII.lic
```

2.5.2 Floating License

*Summary: Run **DFTView --hostid** on the license server system, optionally provide the server hostname*

A floating license provides a centralized way to provide a license for more than one system. Rather than needing to record and track host IDs for potentially dozens or hundreds of individual systems, FlexLM can manage "handing out" licenses from a central pool. In this model, only the host ID of the server system itself is required, so we only need the output of `DFTView --hostid` (***which must be executed on the license server system***) and optionally the server hostname. If you provide the hostname we can add that to the license file for you, otherwise simply replace the generic 'server_hostname' with your server hostname on the SERVER line in the license file. You must also change the VENDOR line in the license file we provide so that it correctly identifies the full location of the *siiid* license daemon (also included in the DFTView® bundle).

With a floating license you can make the license file available to each workstation (called a client) on which DFTView® will run, perhaps by installing on a shared filesystem, or by copying it to the same location on each client system. Then add the location of the floating license file to the LM_LICENSE_FILE variable, just as described in the previous section on node-locked licenses:

```
export LM_LICENSE_FILE=/foo/bar/sourceIII.lic          (bash, zsh)
setenv LM_LICENSE_FILE /foo/bar/sourceIII.lic          (csh, tcsh)
```

If you are using the Synopsys nWave viewer in conjunction with DFTView®, it is most likely that you already have a license server system up and running at your site. In this case, a floating license is better

suited for your setup, and by providing us with the same server hostname and host ID currently in use we can provide you with a suitable license you can incorporate into your current environment. FlexLM allows license files to be combined provided the number of SERVER lines in both files match, and the host ID on each SERVER line is identical. In this way a single FlexLM server system can manage multiple licenses for different products.

2.5.3 Setting up a license server:

If you wish to request a floating license, but do not currently have a license server set up, you will need to run Flexera's *lmgrd* or *lmadmin* programs on a designated server system. We have included a compatible *lmgrd* daemon in the DFTView® bundle, in the support/ directory. At a minimum you would run *lmgrd* and point it to a suitable license file:

```
lmgrd -c /path/to/license/file.lic
```

Note: For security reasons it is advised that you do **not** run *lmgrd* as root.

When using a license server, end-users can point their LM_LICENSE_FILE at a specific port number on your server, instead of at the license file itself, for example:

```
export LM_LICENSE_FILE=5250@server01
```

In this example, the license manager software running on a server named `server01` is already set up to listen for license requests on port 5250. Check with your systems or network administrator if you need to know your license server hostname or specific port number.

There are many other possible configuration options when setting up a floating license server. If you are interested in more advanced topics in FlexLM license administration refer to the detailed License Administration Guide which is available on the Flexera Software support websites:

http://www.flexerasoftware.com/support/

http://www.globes.com/support/fnp_utilities_download.htm#docs

2.5.4 Limited Demo Mode

DFTView® can also be run in DEMO mode (Section 3.2), without a license file. This mode is entered automatically if you do not have a FlexLM license file installed.

2.6 Additional Requirements

To run DFTView® your system must also have the following:

- If using nWave, a Synopsys Verdi license must be available, and the “nWave” and/or “Verdi” commands must be in your path, as well as the “vfast” utility (also shipped as part of the Verdi system)

- If using GTKWave, the “gtkwave” program must be in your path

Many Linux distributions include GTKWave by default, and in most cases this option is recommended (if the command “which gtkwave” returns the path to the gtkwave binary, you're all set). However with some Linux distributions GTKWave is *not* automatically installed, and if your system does not have GTKWave already we recommend that you run the installer (Section 2.1.1) and allow it to download a compatible version for you.

Note: We have identified an issue with GTKWave 3.3.34 on Ubuntu 12.04, where the binary is compiled with a debug library called JUDYMEM. This unfortunately will interfere with DFTView®/GTKWave communication. While we have so far only encountered this issue on one Linux distribution, it may exist on others so again we recommend that you run the installer which will detect GTKWave binaries which may present this problem and alert you before automatically downloading a compatible version from the Source III FTP site.

Once the above setup steps have been performed, you should be able to go to any working directory and run DFTView® on your WGL, STIL, Catalyst, SVF, Advantest T2000, VCD/EVCD and VTRAN®-generated Verigy 93000, Teradyne J750 and FLEX files.

3 RUNNING DFTVIEW®

3.1 Launching the Application

The simplest way to invoke DFTView® is to simply launch it without any arguments:

```
DFTView
```

This will bring-up an empty waveform and DFTView® source window. From here, you can use the **File → Open** operation from the main menu to load a new file. See the discussion below for more details on using this feature.

3.1.1 Command-line Arguments

DFTView® also supports a selection of command-line arguments to allow opening one or more files with certain options enabled. For example if you pass the names of several files at once each one will be opened in a separate tab, *e.g.*:

```
DFTView project1.stil project2.stil project2a.vcd
```

As you can see from this example, all files do not need to be the same format, for each file the format is determined automatically where possible. If using a file with an unknown extension, you can specify the format with the short or long-version option as shown here:

```
DFTView -stil project17.txt
```

-or-

```
DFTView –format=stil project17.txt
```

Use whichever form of the option you prefer. For all command-line options, the short and long forms are functionally equivalent, and you can mix and match short and long forms together.

Note that when specifying multiple vector files the format you define will be applied only to the ***next*** input file in the sequence, so it's best to explicitly name *every* format when passing in multiple vector files (or use known extensions). Thus the specified order of formats must match the order of input files, so all of the following examples are equivalent:

```
DFTView --format=stil STILfile.txt --format=wgl WGLfile.txt

DFTView --format=stil --format=wgl STILfile.txt WGLfile.txt

DFTView STILfile.txt WGLfile.txt --format=stil --format=wgl
```

A full list of supported formats, known extensions, and the shorthand format name to use on the command line can be found in the table in section 1.3.

You can also open a series of files with known extensions and then load additional files into new tabs using the **File → Open** menu option.

The full list of available command-line options is as follows:

Short Argument	**Long-form Argument**	**Feature Description**
-*FMT* ***e.g.* -stil**	--format=*FMT* ***e.g.* --format=stil**	Set named input format, *e.g.* -stil or --format=stil Available formats: **stil**, **wgl**, **t2000**, **catalyst**, **svf**, **flex, j750, j750+, tdl_91, tstl2, 93k, vcd**, **evcd**
-cmd	--commandfile	Read instructions from a command file (section 3.4)
-nobidir	--option=noexplicitbidirs	Disable explicit bidirects (normally on) (section 4.4.1)

Short Argument	Long-form Argument	Feature Description
-nocell	--option=omitscancell	Omit ScanCell blocks (STIL/WGL formats only)
-nochain	--option=omitscanchain	Omit ScanChain blocks (STIL/WGL formats only)
-nostate	--option-omitscanstate	Omit ScanState blocks (WGL format only)
-start *N*	--option=starttime *N*	Set start time to *N* (in ns)
-stop *N*	--option=stoptime *N*	Set stop time to *N* (in ns)
-nowfm	--option=no_waveform	Load source file only; don't display waveform (section 4.8.1)
-nosrc	--option=no_source	Display waveform only; don't load source file (section 4.8.2 - applies to VCD and EVCD only)
-vmode	--mode=vmode	Enable V-mode (93K format only) (section 5)
-cmp	--compare	Enable Compare Mode (section 6)
-lf	--listformats	List all supported input formats
-s	--sync	Enable synced navigation on all tabs (section 4.2.1)
-h	--help	Show all available options
-id	--hostid	Report FLEXnet host ID (section 2.5)
-v	--version	Display version number

Note: In Demo mode, all command-line options other than the “List Formats” `-lf (--listformats)`,

"Show help" `-h` (`--help`), "Report FLEXnet host ID" `-id` (`--hostid`) and "Show version" `-v` (`--version`) options are ignored.

When invoking DFTView® *with* command-line arguments, you should at a minimum provide the source filename(s). The syntax is:

```
DFTView [-wgl|-stil|-93k|etc.] [infile] [timing_file]
```

Note that when viewing Verigy 93K files, both a vector file (.avc or .hptab) and a timing file (.dvc) is required if you wish to generate and display a waveform. Likewise for reading a FLEX file, both a vector file (.atp or .flex) and a timing file are needed. For FLEX, the timing file is a base name. DFTView® will append the suffix `_esets.txt` and `tsets.txt` to the base name to find the edge sets and time sets FLEX timing files. If you specify a file which normally requires a timing file, but you do not provide it, of if you use the `--option=no_waveform` command-line option, DFTView will open the source file but will not attempt to generate a waveform. You can later click the 'Generate Waveform' button to display the waveform, and DFTView will prompt you at that time for a timing file, if it needs one. See Section 4.8.1 for more information.

You can also define input arguments such as filename, start time *etc.* in an ASCII command file. See Section 3.4 for details.

Some command line examples for invoking DFTView® are:

```
DFTView
DFTView ovf.svf
DFTView -wgl myWglFile
DFTView -stil myStilFile
DFTView --format=wgl ovf.wgl.gz
DFTView -93k maximo.avc maximo.dvc
DFTView --format=93k sample.hptab sample.dvc -vmode
DFTView sample.avc sample.dvc --mode=vmode
DFTView --commandfile input.cmd
```

```
DFTView --compare sample.stil sample.vcd'
DFTView -nowfm input.evcd
DFTView --option=no_waveform input.evcd
```

3.1.2 Operation

DFTView® begins by converting the source file to a waveform viewing file for either nWave or GTKWave. It then automatically loads the waveforms in the display program (if possible) and all signals are selected. In addition the contents of the source vector file are loaded in the DFTView® text editor. Once the source file is loaded and displayed in the DFTView® window, you can begin viewing and editing.

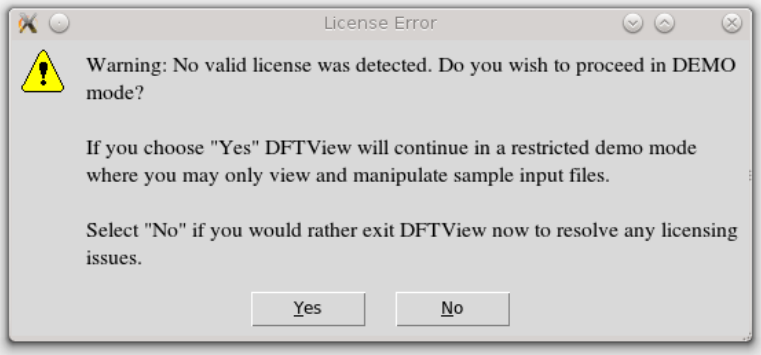
Note that vector files can be gzipped and will be expanded automatically, but timing files (for those formats that use them) **must** be provided uncompressed (Section 4.4.1).

You can, if loading 93k format vector and timing files on the command line, also provide an optional `-vmode` (or longer-form `--mode=vmode`) argument which will put the editor directly into V-mode (Section 5). The `-vmode` argument is ignored for other file input formats. As with normal mode, you can elect to omit the timing file name, and the source file will be opened in V-mode without displaying the associated waveform.

The nWave or GTKWave window is used to scroll through signals and event times to view the waveforms. Refer to the Synopsys documentation for using nWave or the documentation for GTKWave for its use.

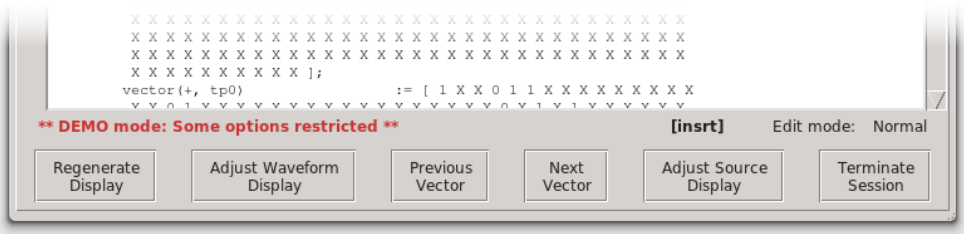
3.2 DFTView® Demo Mode

When you run DFTView®, if you have not purchased a license key or if there is an issue with the license, a dialog box will appear giving you the option of running in DEMO mode for evaluation, as shown here:


License Error
Warning: No valid license was detected. Do you wish to proceed in DEMO mode?
If you choose "Yes" DFTView will continue in a restricted demo mode where you may only view and manipulate sample input files.
Select "No" if you would rather exit DFTView now to resolve any licensing issues.
Yes
No

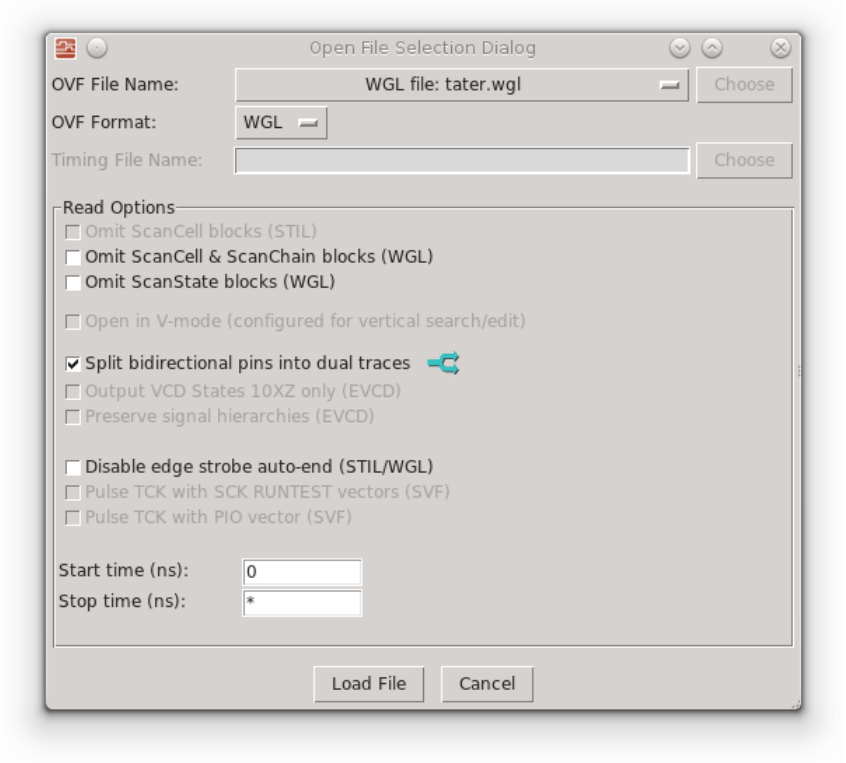
If this dialog appears and you *have* purchased a license or have received an evaluation license, you can select “No” here to exit the application and address whatever license issue you may have – check the parent terminal window where you launched DFTView® for specific license-related messages.
If you select “Yes”, you will enter DEMO mode. In this mode, DFTView® will allow you to view and interact with a set of demo files shipped with the application, but will not allow you to view, edit or save your own files. Also note that if DFTView® enters DEMO mode, any command line arguments you may have passed when launching the application (*e.g.* an input filename or format) will be ignored.

You can always tell if DFTView® is running in DEMO mode – it will be clearly indicated near the bottom left of each tab in the main application window as shown:



3.3 Running in Demo Mode

As with normal (licensed) mode, you can select **File → Open** to select an input file. In DEMO mode however, the file open dialog box will appear slightly different to the regular licensed version, as shown below – The "Choose" buttons will be disabled and the OVF File Name will not allow you to type in a filename. Instead, you will be presented with a drop-down list of demo files (which are shipped with the application and reside in the $DFTVIEW_ROOT/demo/ directory). Other options such as Omitting ScanCell and ScanChain blocks, start and stop time etc. are available if you wish to try them out.



The OVF Format will be set for you each time you select a new demo input file, although you may

select it manually if you wish. If you select a demo OVF file which also requires a Timing file, that field will be set for you automatically.

Once you've selected and opened a demo file, it will be displayed in the main application window and in the waveform viewer (if configured). All the normal controls for navigating around the file will be available to you, and you can also make limited edits to the input file to see the resulting changes in the waveforms.

If the drop-down list of OVF file names appears to be empty, verify that your `$DFTVIEW_ROOT/demo/` directory and the contents therein are readable. Also note that adding other files to the demo directory does ***not*** make them readable by DFTView® in DEMO mode.

In addition, you can view the provided 93k demo files in V-mode (Section 5). Once opened in V-mode feel free to make minor changes to the file using the various operations in Section 5 as a guide. Of particular note, we have provided a sample pin-formatting file `sbc.example.fmt` which can be applied to the `sbc2.avc` and `sbv2.dvc` files if opened in V-mode. Select the **Edit → Load V-mode format file** operation from the menu and select the example format file. You can view and edit this plain ASCII format text file in a standard text editor such as *`vim`*, *`nedit`* or *`emacs`*; the format of this file is explained in Section 5.7.

3.4 Command File

In order to provide more flexibility in passing parameters and using scripts to drive the viewing, an optional command file can be passed to DFTView® as described above. This section discusses the contents of a DFTView® command file. All of these features can also be accessed from the DFTView® GUI in interactive mode.

Long load times for large WGL/STIL files can occur due to the flattening of cycle-based files to event streams for waveform display, especially when scan data is present. DFTView® has been enhanced to allow the user the option to specify a subset of cycle times. In the future, it will be enhanced to allow

the user the option to specify a subset of signals. The Reader generates a waveform display file that only includes the data for the specified time range.

The START_TIME and STOP_TIME commands define the first and last event times to be included in the waveform display file. If START_TIME is not specified, it defaults to 0ns. If STOP_TIME is not specified, it defaults to the last event in the input vector file. The syntax is:

START_TIME *n*;
STOP_TIME *n*;

where *n* is a positive integer or real number.

The command line arguments also are specified in the command file, when a command file is used. The syntax is:

FORMAT wgl|stil|93k;
INFILE <filename>;
AUXFILE <filename.dvc>;
UNITS <units>;

The FORMAT and UNITS commands are optional. An example of a DFTView® command file, named runDFTview.cmd, is:

```
INFILE myDesign.stil;
START_TIME 100;
STOP_TIME 50000;
```

To invoke DFTView® using this command file, the command line is:

```
DFTView -cmd runDFTview.cmd
```

-or-

```
DFTView --commandfile runDFTView.cmd
```

(note that the short- and long-form arguments are functionally equivalent).

The waveform file created by the DFTView® in this example will only contain events from the STIL file starting at 100ns and ending at 50000ns, inclusive.

Note: If you use a command file all other command-line arguments will be ignored to avoid any conflicting settings.

> ***Tip:*** *Loading files which define large numbers of vectors (millions or more) may take a long time since DFTView® flatten loops and repeats when generating the vectors so that they can be displayed. We recommend that you avail of the START_TIME and STOP_TIME feature which allows you to quickly load an area of interest without having to load all vectors. If you don't wish to use a command file you can also specify the start and stop times via the File/Open dialog (see section 4.4.1).*

4 DFTVIEW® NORMAL MODE

4.1 Overview

When you launch DFTView® you will see a source file editing window and, depending on which waveform application you configured, a waveform viewer window – a separate application which DFTView® will launch on your behalf. The main source editing window contains a number of menu operations as well as one or more tabs, each with a control panel of buttons on the bottom. In summary these operations and controls are:

- **Control Panel Buttons:**
  Regenerate Display (button)
  Adjust Waveform Display (button)
  Previous Vector (button)
  Next Vector (button)
  Adjust Source Display (button)
  Close Current Tab (button)

- **File (drop-down menu):**
  File → Open
  File → Close
  File → Regenerate Display
  File → Save Source
  File → Exit

- **Edit (drop-down menu):**
  Edit → Undo
  Edit → Redo
  Edit → Reset Preferences
  Edit → Set Font Size
  Edit → Toggle Insert/Overstrike
  Edit → Previous Vector
  Edit → Next Vector
  Edit → Go To Line Number
  Edit → Go to Time Point
  Edit → Go to Cycle
  Edit → Search

- **Tools (drop-down menu):**
  Tools → Compare Files
  Tools → Merge/Split Bidirs in Display

- **Help (drop-down menu):**
  Help → About
  Help → Context-Sensitive Help
  Help → File → *selection*
  Help → Edit → *selection*
  Help → V-mode → *selection*
  Help → Buttons → *selection*

4.2 Source Editor

The main portion of the DFTView® display window is the text editor itself. You can make edits to your source and then click the ***Regenerate Display*** button to see how your edit will affect the waveform (Section 4.3.1). You can also elect to save your modified source (Section 4.4.1). Note that for some formats, especially those which require a separate timing file, edits which add new signals are not recommended, and in fact may cause DFTView® to detect these additions as errors.

4.2.1 Editor Tabs

Multiple separate source files can be loaded into separate tabs, and a new tab will be automatically created for each file you open. In addition, the new waveform will be displayed in a separate pane or window in your chosen waveform viewer.

You can switch between tabs by simply clicking on the name, which will be the open file for that tab. As you switch tabs, focus will automatically also switch in the waveform viewer window or pane.
Any time you close a file that tab (and the associated waveform view) will be closed. Tabs provide a convenient way for viewing multiple input files.

4.2.2 Synchronized Navigation

Each tab has a “Synchronize Tabs” checkbox at the top right. At any time you can check this box (in any tab) and all tabs will become synchronized. Now when you perform any operation which adjusts

the selected time point in a source window (*e.g.* **Next Vector**), the same time point will be selected in all other tabs (and associated waveforms viewers windows) simultaneously. This is very useful for comparing multiple source files which describe the same vectors – for example files which have been translated by Source III's VTRAN® software. This option is enabled automatically when viewing results of a compare operation using DFTView® Compare Mode (Section 6).

4.2.3 Contextual Menu

The source editor window displays a pop-up contextual menu when you click with the right mouse button, and provides short-cut access to some basic tools. In normal edit mode, you can select a section of text and right-click to select “copy” or “paste” options. In addition, in V-mode (Section 5) the “smash” and “compress” options will be enabled where applicable (if the cursor is on a loop or repeat line – see Section 5.5).

4.2.4 Undo/Redo

Changes to your source file can be undone with the “Undo” and “Redo” options. DFTView® provides unlimited undo (meaning you can undo as many edits as you've made) in each tab, with one major caveat. In V-mode when a repeat or loop is smashed or compressed (Section 5.5) or V-mode formatting is applied (Section 5.7) these changes also require other data modifications, and after these operations are performed the undo stack is reset. In these cases, DFTView® will always provide an inverse operation for you to use. For example if you smash a loop, just compress it to get back to where you were. Similarly, if you applied a V-mode formatting file, remove the formatting in the same way. In other words, you cannot “Undo” an operation such as this by selecting the **Edit → Undo** menu option, you need to perform the inverse operation yourself.

4.3 Button Controls

4.3.1 Regenerate Display

The **Regenerate Display** button is used to update the data displayed in the waveform window, after modifying the source file vector or timing data with the DFTView® editor. This button does NOT

update the original source file specified on the command line or in the command file. In some circumstances when you make changes to your source file, you may see this button begin to flash. This occurs as a reminder that the waveform and source files are now possibly out of sync, and you should click this button once you have completed any additional edits you wish to make. You will usually see this button flash after you have performed a *Smash* or *Compress* operation (Section 5.3).

If you haven't yet generated a waveform (for example you specified no timing file(s) for a format which requires them, or used the `--option=no_waveform` command-line option – see Section 4.8.1), this button will be labeled **Generate Display**. Conversely if you elected to display a VCD or EVCD waveform without loading the source file into the editor window (see Section 4.8.2), this button will be labeled **Load Source File**.

4.3.2 Adjust Waveform Display

The **Adjust Waveform Display** button is used to synchronize the waveform display with the DFTView® source editor display. This can be used in several ways:

- When clicked on a Procedure Call, Macro, Main Pattern Loop/Repeat, or Main Pattern Scan statement in the Source Display, causes the waveform viewer and the text editor's cursors to move to the first cycle of the pattern structure; W and C statements, for example, are skipped. Repeated clicks act as Next Cycle until the end of the structure. When clicked at the end, causes a return to first cycle of the pattern structure.

- When clicked on a Loop or STIL Shift inside a Macro or Procedure, the behavior is the same as Loop in the Main Pattern, except clicking on last (end) cycle results in falling out of the Loop or Shift.

DFTView® sets the waveform cursor to adjust the display. Any user setting of the cursor will be overridden. For a multiple-line vector in the source file editor, the editor's cursor must be set to the first line of the vector.

This control is disabled when the source file has been loaded without a waveform as in Section 4.8.1).

4.3.3 Previous Vector

The **Previous Vector** button and menu option provides a means to step sequentially backwards through vector statements in the source file while also moving the waveform display to the corresponding waveform location. The keyboard shortcut **Ctrl-<** (Control and less-than sign) can also be used.

This control is disabled when the source file has been loaded without a waveform as in Section 4.8.1).

4.3.4 Next Vector

Steps sequentially forward through vectors. Repeated clicks before or during a procedure, Macro, or Loop/Repeat in the Source Display causes the waveform viewer and the text editor's cursors to move through the pattern structure. When clicked at end of a pattern structure, causes the cursors to advance to vector related statements following the procedure, macro, or loop/repeat pattern structure.

When clicked on a Scan or STIL Shift statement, causes the Scan/Shift pattern structure to be skipped. The cursor/marker advances to the next vector related statement. The keyboard shortcut **Ctrl->** (Control and greater-than sign) can also be used.

This control is disabled when the source file has been loaded without a waveform as in Section 4.8.1).

4.3.5 Adjust Source Display

The **Adjust Source Display** performs the opposite function as the Adjust Waveform Display described above. In this case, the waveform cursor is first placed over a desired location in the waveform window. Then when the Adjust Source Display button is activated, the cursor in the source file window is adjusted to display the vector line which generated the waveform at the selected location.

This control is disabled when the source file has been loaded without a waveform as in Section 4.8.1).

4.3.6 Close Current Tab

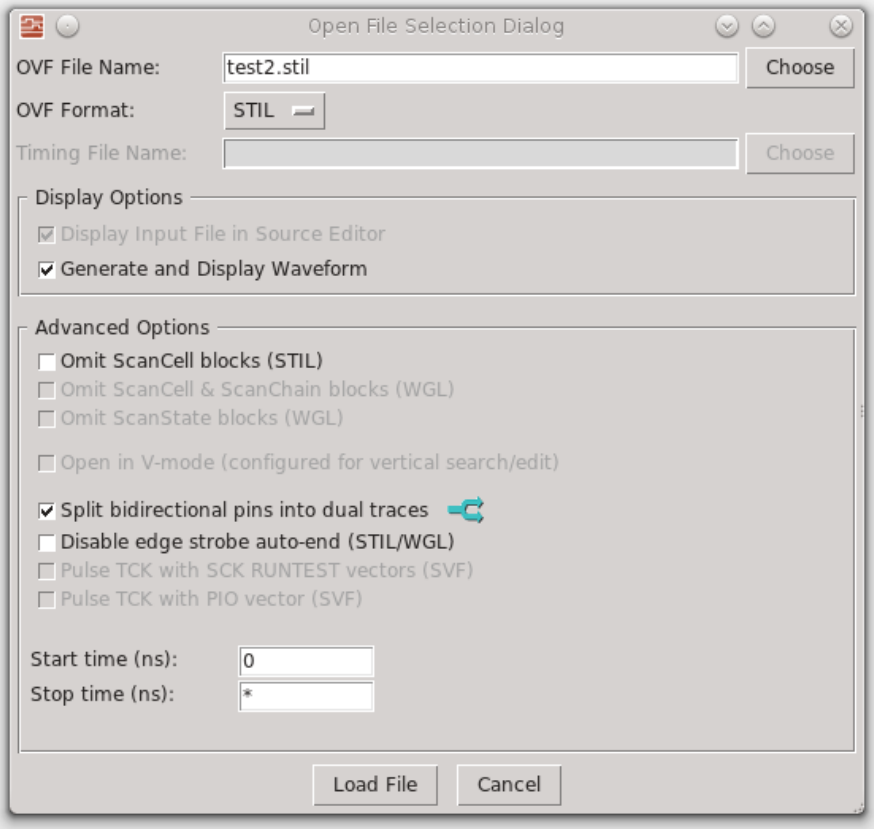
The **Close Current Tab** button is used to close the current tab and associated waveform, along with cleaning up any temporary files associated with it. You ***do not*** need to close one tab before opening another – you can open several files (each in its own tab) and easily switch between them, and you can also then run DFTView Compare on them (Section 6).

4.4 Menu Options

4.4.1 File Menu

4.4.1.1 Open

This selection is used to load a new source file into the DFTView® text window. It also causes the file to be mapped to its equivalent waveform in the waveform display window. During this operation the source file is checked for syntax errors and if any are found an error message is displayed, with a more detailed message in the parent window. When you select **File → Open** (or use the keyboard shortcut) a query window to appear which has a text field for the source filename and, if necessary, a separate timing filename. The query window also has a Choose button which allows you to browse the files on your machine and select the desired one to be loaded. Once the source file is chosen, DFTView® will try to determine the format of the file by looking at the file extension, and use this information to set the “OVF Format” selection. Always check that this selection is correct and choose a format manually if necessary.



The **File → Open** dialog contains several optional read parameters called *Read Options*. Which are further separated into *Display Options* and *Advanced Options*. These control options such as electing to not display a waveform, omitting sections of the input file which are not necessary for editing, display bidirectional signals as merged (single-trace) or split (dual-trace) in the waveform viewer, etc. In addition, a Start time and Stop time can be optionally provided; loading and displaying very large files can take a significant amount of processing time and these settings are provided to help you minimize this. With the exception of the "Open in V-mode" option below, these options control how the waveform traces are drawn in the waveform viewer application, but not how the original vector file is loaded into the source editor.

- ***Display Input File in Source Editor***

  For most file formats this option is checked and disabled, meaning the option is always active.

This is because for most formats, it doesn't make sense to open the file without displaying it in the normal editor window. For VCD and EVCD files however, this option is editable, although still enabled by default. For these formats it can be switched off so that the file is displayed as a waveform only.

Note that in this mode, the editor window (Section 4.2) will be largely empty, and most of the source/waveform interaction controls (Section 4.3) will be unavailable. This option can be disabled on the command line with the `-nosrc` or `--option=no_source` command-line options (again for VCD/EVCD only).

- ***Generate and Display Waveform***

  This option is also enabled by default, but unlike the previous one is also always editable. When unchecked DFTView will open the source file in an editor as normal, but without generating any waveform representation. In this mode most of the source/waveform controls will again be disabled, although you can elect to generate and display the waveform at any time, thereby enabling them.

  This option is useful for viewing larger source files without waiting for the waveform is be displayed, and is especially useful for displaying source file without the associated timing files (*e.g.* when editing 93K files in V-mode – see Section 5). In V-mode, you can even apply formatting (Section 5.7) first, and then elect the display the relevant waveforms.

  You can disable this switch from the command-line with the `-nowfm` or `--option=no_waveform` switches.

- ***Omit ScanCell blocks (STIL)***
- ***Omit ScanCell & ScanChain blocks (WGL)***
- ***Omit ScanState blocks (WGL)***

  It is often the case that Scan Cell name and list information takes up a significant percentage of STIL and especially WGL file sizes. For viewing these files and their corresponding

waveforms, this information is usually not needed. Selecting the Omit options for these blocks may greatly reduce the amount of text data that needs to be brought-up in the text widget.

- ***Open in V-mode (configured for vertical search/edit)***

  This option is available for HPTAB / HP93000 files only, and provides an alternate columnar format for viewing and browsing that format, as detailed in Section 5 where DFTView® V-mode is explained in detail.

- ***Split bidirectional pins into dual traces***

  This option is available for all input formats which DFTView® supports, with the exception of VCD and EVCD; it is enabled by default. When parsing the input file, this option controls whether bidirectional pins will be displayed merged, as a single trace, or split, as two traces – one for input, one for output (Section 4.6). This option is grayed out for VCD and EVCD files because the waveform viewer applications support both of these formats; the "raw" file is the input for the viewer. Bidirectional signals will be split or merged in the waveform viewer, depending on how they are represented in the input file.

- ***Disable edge-strobe auto-end (STIL/WGL)***

  Enable this option (for STIL and WGL formats only) to modify when the edge strobe changes to an X from the start of each cycle to instead only when the new state is assigned to the individual signal.

  This option behaves the same way as the NO_EDGE_STROBE_AUTO_END flag does in VTRAN®.

- ***Pulse TCK with SCK RUNTEST vectors (SVF)***
- ***Pulse TCK with PIO vector (SVF)***
- These options enable TCK pulsing in the waveform viewer whenever a SCK RUNTEST or PIO vector is encountered in an SVF file (by default the TCK does not pulse in these situations).

- ***Start time (ns)***
- ***Stop time (ns)***

  Finally, for those cases where a user knows the particular area (range) in the test timeline that they would like to view, it can save substantial translation compute time by specifying that time range with the Start and Stop time parameters. The default for these is 0 to * (max time in file). You can also split bidirectional signals into separate input and output signals (this is enabled by default – see Section 4.6) and for 93K format files you can enable V-mode (Section 5).

For most of the options displayed in this dialog, there are comparable command-line options which can be used. For example, to read a STIL file with the "Omit Scan Cell Blocks" option enabled and dual traces for bidirectional pins turned off, you can invoke DFTView® like this (line split for clarity):

```
DFTView --option-omitscancell \
        --option=noexplicitbidirs \
        --format=stil inputfile.stil
```

A full list of available command-line options (Section 3.1.1) can be displayed with:

```
DFTView –-help
```

> ***Tip:*** *When loading files which will generate large numbers of vectors (millions or more) it may take a considerable time to load. DFTView® flattens loops and repeats when generating the vectors for display, and this can take some time. In this situation we* ***highly*** *recommend that you avail of the Start and Stop time parameters which allow you to quickly load an area of interest without having to load every vector.*

> ***Tip:*** *Gzipped input source and vector files will be unzipped automatically if a .gz extension is detected. Note that in this release, with formats that require one or more timing files, the vector file can be gzipped but the timing file(s) must not. If your timing files are gzipped you must manually unzip them first.*

4.4.1.2 Close

Closes the currently open and loaded file, and closes both the associated text (source viewer) tab and waveform pane or window. You ***do not*** need to close one input file before opening another one.

4.4.1.3 Regenerate Display

Used to update the data displayed in the waveform window, after modifying the source file vector or timing data with the DFTView® editor. This selection does NOT update the original source file specified on the command line, the command file or specified with the **File → Open** menu. This selection functions identically to the Regenerate Display button.

4.4.1.4 Save Source

If you make changes to your source file - for example, after locating and fixing a highlighted error (Section 4.5), you can save your modified file. You will be prompted for confirmation if you wish to overwrite your original file (or any other file which already exists).

Append a `.gz` extension to your output filename if you would like it to be compressed automatically for you.

4.4.2 Edit Menu

4.4.2.1 Undo/Redo

Source editor Undo and Redo operations are described in Section 4.2.4, “Undo/Redo”.

4.4.2.2 Reset Preferences

DFTView® maintains a preferences file in the user home directory under a hidden “dot folder” named `~/.sourceiii/`. The preferences file stores some basic DFTView® parameters such as main window size and location, selected font size, and so on. If you delete this file all preferences will be reset to the

default values the next time you run DFTView®. However if you delete this file *while DFTView® is running* another one will be generated when DFTView® exists. Selecting this menu operation will not only remove the preferences file, but will also prevent DFTView® writing a new one at exit, so that the next time you launch DFTView® all settings will be restored to their default values.

4.4.2.3 Set Font Size

The font used in the source editor window can be modified, by selecting one of the preconfigured sized listed under this sub-menu. Currently a range from 10-point to 20-point sizes (in steps of 2) are available, the default size being 12. Changes to the font size will take effect immediately, in all open tabs, and this setting will be preserved in the preferences file.

4.4.2.4 Toggle Insert/Overstrike

In Normal mode, the cursor in the source editor is placed in **Insert** mode. As with a standard text editor, characters are inserted at the cursor position. By selecting this option, using the keyboard shortcut 'Insert' (Section 4.7), or by clicking the **[insrt]** icon near the bottom right of the open tab, you can switch this to **Overstrike** mode (the icon at the bottom right will change to read **[over**]). In this mode, the character under the cursor is replaced by whatever you type, and the backspace and delete keys will not change anything. Selecting the menu option or keyboard shortcut again will toggle back to **Insert** mode.

As a convenience, in V-mode (Section 5) the editor is automatically place in **Overstrike** mode, but this can similarly be changed as desired.

4.4.2.5 Previous Vector

Selects the vector just before the current one. Described in Section 4.3.3.

4.4.2.6 Next Vector

Selects the vector just after the current one. Described in Section 4.3.4

4.4.2.7 Go to Line Number / Go to Vector

Brings up a query window with a text field for entering a line number. After entering a line number, activating the “Go To” button will cause the cursor in the DFTView® text display window to move to the specified line number in the source file. Activating the **“Adjust Waveform Display”** button (Section 4.3.2) after this will then cause the waveform display to move to the corresponding location.

In V-mode (Section 5) the “Go to Line Number” menu entry is changed to “Go to Vector”. The operation is almost identical except that the cursor will be placed on the desired vector rather than the line number.

4.4.2.8 Go to Time Point

This selection brings up a query window with a text field for entering a time point (in nanoseconds). After entering a time point number, activating the “Go To” button will cause the cursor in the DFTView® text display window to move to line in the source file most closely matched with the requested time point. Activating the **“Adjust Waveform Display”** button (Section 4.3.2) after this will then cause the waveform display to move to the corresponding location.

4.4.2.9 Go to Cycle

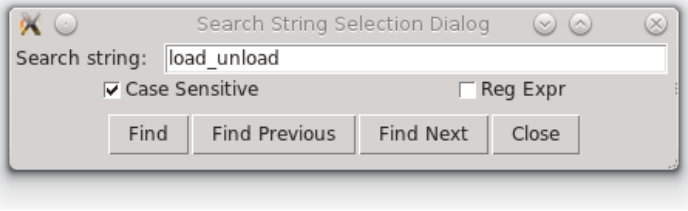
This selection brings up a similar query dialog where you can enter the desired cycle number and click “Go To”. Activating the **“Adjust Waveform Display”** button (Section 4.3.2) after this will then cause the waveform display to move to the corresponding location.

For some formats, a cycle number is not available (such as print-on-change formats like VCD and EVCD). This option will be disabled for those formats.

4.4.2.10 Search

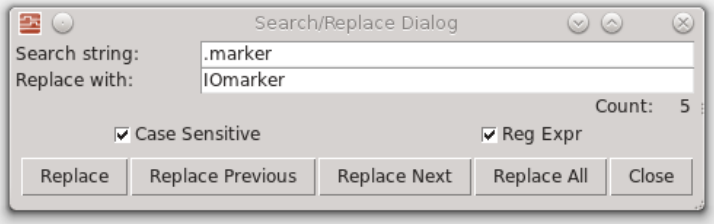
Brings up a query window where a text string can be entered. The “Find” button in the window can then be used to position the cursor over the location in the DFTView® text window where this text finds

a match. After one search, the “Find Previous” and “Find Next” buttons can be used to continue the search.



4.4.2.11 Search/Replace

Brings up a query window where search and replace strings may be entered. As with the Search operation (Section 4.4.2.10) you can elect to perform non case-sensitive as well as regular expression searches. The screenshot below shows a regular expression being used as a search string, and also shows the “Count” indicator which displays the total number of strings replaced from the most recent “Replace All” operation.



4.4.3 Tools Menu

4.4.3.1 Compare Files

Brings up a new Compare Files window where a Compare operation can be configured and run (Section 6).

4.4.3.2 Merge/Split Bidirs in Display

When a vector file has been opened and the waveform has been displayed, this menu option will regenerate the waveform with or without bidirectional signals being split into inputs and outputs (Section 4.6). This effectively allows you to toggle the bidirectional signals in the waveform, but this is not instantaneous – the vector file will be regenerated.

4.4.4 Help Menu

The **Help** menu is located on the right-hand side of the menu bar. The first item is **About** which will display an application banner which will indicate which version of the DFTView® you are running. *(Note: If at any time you have a question for Source III please include the version number of the application, visible in this "About Box", or simply by typing* `DFTView -v` *on the command line).*

4.4.4.1 Help Browser

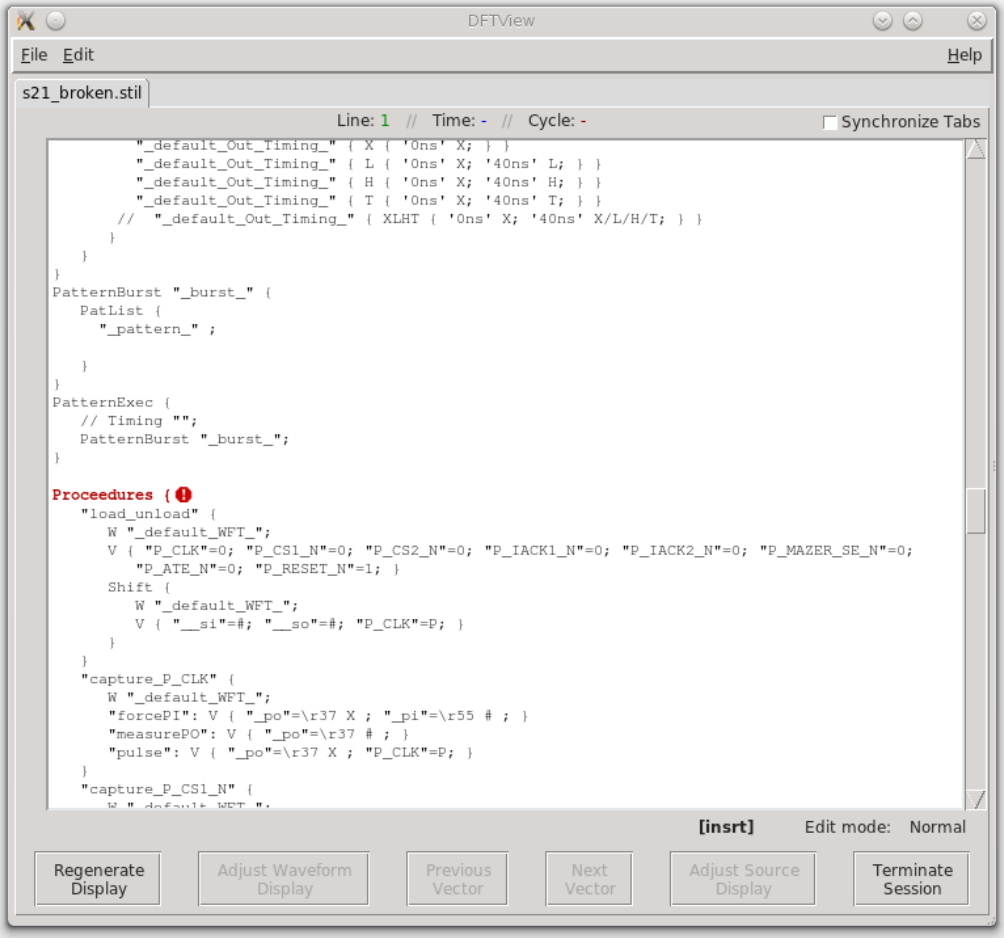
After the "About Box", the **Help** menu contains a series of entries each of which will display the application's built-in help for that option. So for example, selecting **Help → File → Save Source** will display the help text for the **File → Save Source** menu option. The help browser will remember each entry as you view it, much like a web browser does, and provides a "Back" and "Forward" button to let you navigate back and forth, which is useful as you navigate through help files which provide hyperlinks to additional help entries. Note however that this browsing "history" is ***not*** preserved when you exit the DFTView® application.

4.4.4.2 Contextual Help Browser

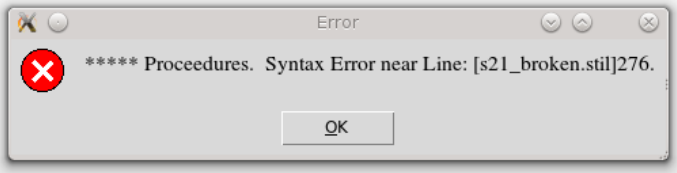
As well as the normal online help browser (Section 4.4.4.1) DFTView® also provides a Context sensitive help feature, which you can activate from the **Help → Context-Sensitive Help** menu option. This opens a window, similar to the normal Help browser, but which will only display information relevant to the operation you are interested in. Move your mouse pointer over any area or control widget in the DFTView® application. If any specific information is available it will be immediately displayed.

4.5 Error Detection

If DFTView® detects any error while parsing STIL or WGL format input files, it will not attempt to display any waveform data in the viewer. It will display the input source file in the DFTView® text editor as usual and will then jump to the line in the input file which generated the error and highlight. In the following example, the *Procedures* statement has been misspelled:



In addition to this, the relevant error message will be displayed in a standard dialog box:



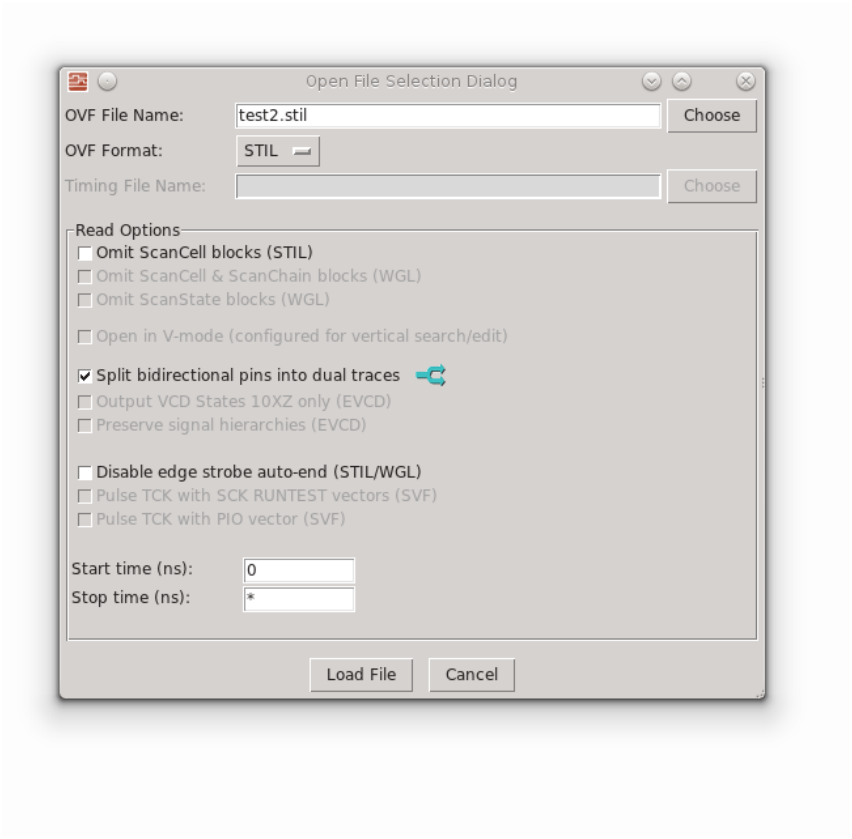
After you've dismissed the error box you can get it to display the error again by clicking on the little "stop" icon next to the highlighted error. At this point you can manually edit the file in DFTView® and when you're ready click the "Regenerate Display" to re-parse the edited file. This will cause DFTView® to re-parse the file, and will at this point display the waveforms in the viewer, or highlight additional error messages if detected.

4.6 Separating Bidirectional Pins

All supported input formats (other than VCD) now support a split bidirectional pin option which changes how bidirectional pins are displayed in the chosen waveform viewer.

4.6.1 File/Open Dialog

This option is available in the File/Open dialog . When checked (the default state) all bidirectional pins in the input file are split into input and output pins, clearly labeled, in the resulting waveform display. This does not in any way alter the content of the input file. This option is only available via the **File/Open** dialog (Section 4.4.1). Note that this option is *always* enabled by default. Uncheck this box (or pass the `--option=noexplicitbidirs` command-line option) if you wish to view bidirectional signals as a single trace in the waveform viewer. You can also click the blue arrow icon just alongside (Section 4.6.3).



4.6.2 Change via Tools Menu

Once you have displayed your file with dual-trace (split) or single-trace (merged) bidirectional signals, you can switch between these display formats at will using the **Tools → Merge/Split Bidirs in Display** menu option. See Section 4.4.3.2 for more information on this operation.

4.6.3 Change via Display Icon

For convenience the current state (merged or split) of the waveform display is indicated by the blue arrow icon below the main source editor.

Two arrows merging into one indicates merged (single-trace) bidirects.

One arrow splitting into two indicates split (dual-trace) bidirects.

As well as offering this visual indicator, you can at any time click on the icon to switch between merged and split waveform displays. Each time you click, DFTView® will regenerate the waveform just as it does when you use the Tools menu (Section 4.6.2). A gray version of the icon indicates that the option is not currently available, *e.g.* when viewing VCD or EVCD input formats (Section 4.4.1.1).

4.7 Keyboard Shortcuts

Most operations in DFTView® have keyboard shortcuts mapped to them. The majority of these shortcuts are displayed on the relevant menu options, and are reproduced in the following table. For each menu option and button the corresponding keyboard shortcut is displayed, along with a link to the relevant section in the User Guide, if appropriate.

Operation	Shortcut	Section
Open File	Control **O**	4.4.1.1
Close File	Control **W**	4.4.1.2
Regenerate Display	Control **R**	4.4.1.3
Save Source	Control **S**	4.4.1.4
Exit	Control **Q**	4.4.2.8
Undo	Control **Z**	4.2.4
Redo	Shift Control **Z**	4.2.4
Toggle Insert/Overstrike	**Insert**	4.4.2.4
Previous Vector or Miscompare	Control < (or Control **,**)	4.3.3
Next Vector or Miscompare	Control > (or Control **.**)	4.3.4
Go to Line/Vector	Control **L**	4.4.2.7
Go to Time Point	Control **T**	4.4.2.8
Go to Cycle	Control **Y**	4.4.2.9
Search	Control **F**	4.4.2.10
Vertical Search	Control /	5.2
Vertical Search/Replace	Control |	5.3
Locate Pin/Signal	Control **P**	5.4
Smash	Control +	5.5
Compress	Control -	5.5
Go to Previous Change	Control **[** (left square bracket)	5.6
Go to Next Change	Control **]** (right square bracket)	5.6
Compare Files	Control **K**	6

4.8 Disabling Waveform or Source Editor Function

In typical use, source files opened in DFTView® are displayed in a source editor and an associated waveform is displayed in the pre-configured view application (Section 2.4). In some circumstances it may be preferable to change this behavior, viewing just one or the other.

4.8.1 Disabling Waveform

For all supported input formats, you can elect to disable or defer waveform generation and display. You can either use the `-nowfm` or `--option=no_waveform` arguments when specifying the source file name(s) on the command-line (Section 3.1.1), or deselect the “Generate and Display Waveform” display option in the File/Open dialog (Section 4.4.1.1). The source file will be opened and displayed in the editor as usual, but the waveform application will not be launched, and the source ↔ waveform interaction controls such as “Previous Vector”, “Next Vector” *etc*. will be disabled since there is no waveform to interact with (Section 4.3).

This mode of operation cuts down on file load times, since the task of generating the vectors for display along with the source/waveform mapping to keep everything synchronized does not need to be executed. In addition, file formats such as T2000, 93K/HPTAB which require timing files for display can be loaded without them. Source-only features like search, and all the V-mode operations (Section 5) including V-mode file formatting, are fully accessible when no waveform is displayed.

At any time, even after editing/changing a source file displayed in this fashion, you can elect to click the 'Generate Display' button (or select the similarly-named menu option) and the waveform will be computed and displayed. If timing files are needed at this stage, you will be prompted for them automatically.

4.8.2 Disabling Source Editing

For VCD and EVCD files, you may instead opt to load and view the waveform without loading the source file at all. Use the `-nosrc` or `--option=no_source` command-line options, or deselect the “Display Input File in Source Editor” display option in the File/Open dialog.

This mode of operation can reduce load times, especially for large files since the mapping functions to keep the source and waveform in sync do not need to be executed. Again because the mapping operation is deferred, the interaction controls will not be available, but the source file can be loaded later by means of the “Load Source Files” button or menu option. This will open the source file in the DFTView® editor, and also generate the vector mapping needed for normal source ↔ waveform interactions.

Note: *In the case of VCD and EVCD files, where both these options are selectable, note that you must select at least one or the other, or select both. You cannot proceed if you deselect both options (since you're telling DFTView® to not do anything!).*

> ***Tip:*** *When comparing files (Section 6) both files must be opened with source (VCD/EVCD) and waveform (all formats). When you attempt to compare files without source or waveform being displayed, you will be prompted to correct this before you can continue. See also “Entering Compare Mode“, Section 6.2.*

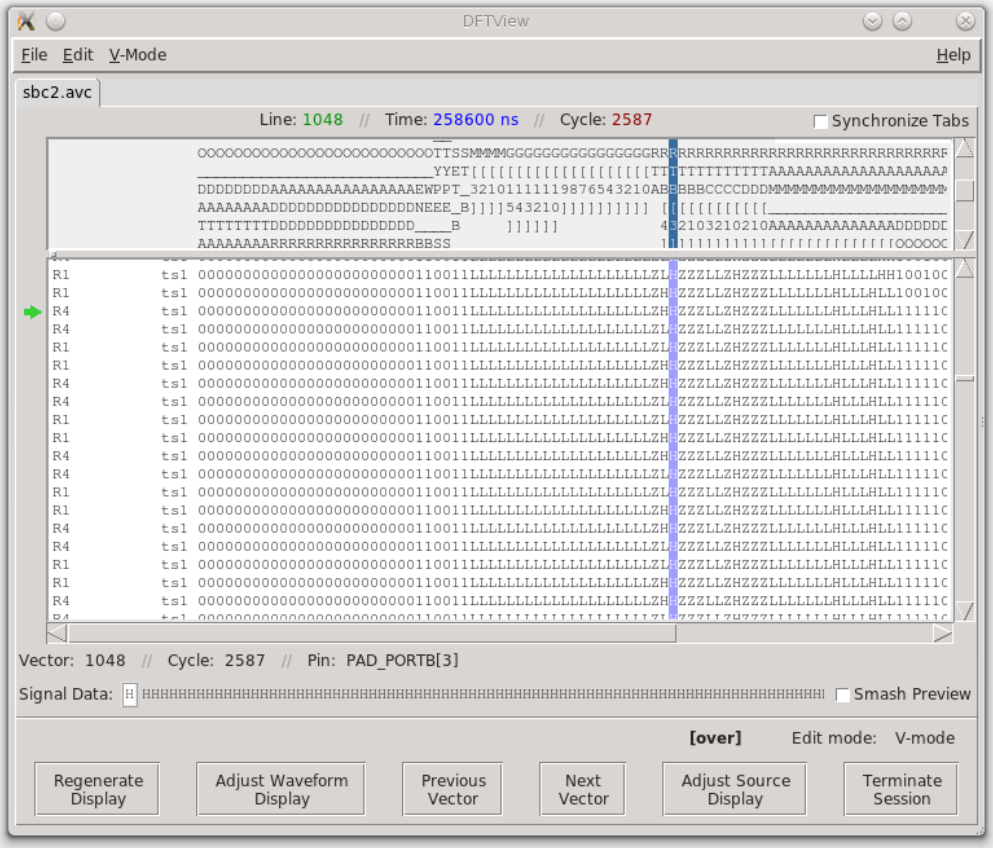
5 DFTVIEW® V-MODE

5.1 Overview

When opening 93k format files in the File/Open dialog, the option to enable V-mode will be available (it will be disabled for other input formats). Selecting this option will alter how the input file is presented to you (although the various controls for interacting with the waveform viewer will not change). As described in "**Running DFTView®**" (Section 3), if passing the names of the input vector and timing files on the command line you can also specify the `-vmode` command line argument to switch automatically into V-mode.

With V-mode enabled, pin state data is displayed in tabular fashion where each column represents the state of a single pin over time, and above the main display a secondary display will vertically label each pin name, aligned over the correct pin state column. Unlike the normal edit mode, lines in V-mode will not be wrapped automatically, and instead a horizontal scrollbar will appear to allow you to view additional pins if they do not all fit in the window at once.

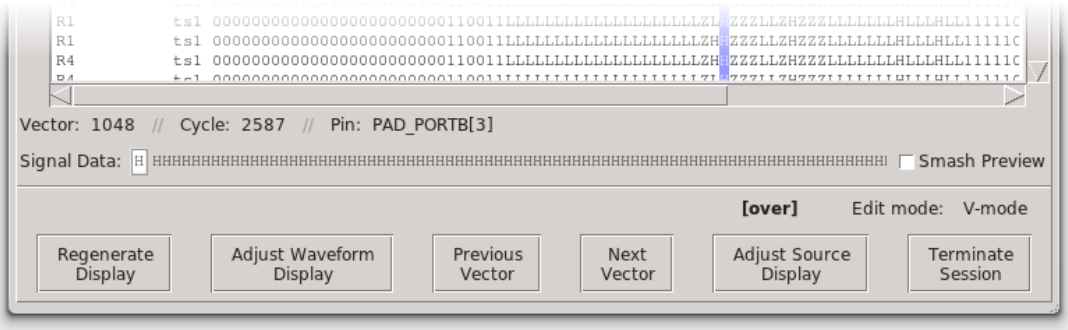
> ***Tip:*** *When a 93K file is opened in V-mode the Cycle and Vector numbering begins at 0 instead of 1, to match the behavior of the Advantest testers. However, the Cycle number still begins at 1 for 93K files displayed in normal mode, just as it does for any other format. This is* ***especially important*** *to remember if you synchronize two tabs (Section 4.2.2) where only one is in V-mode, as it may appear that the cycle numbers are off by one.*



When displayed in V-mode the file will be represented as a series of vectors and possibly loops (you can identify these by the SQPG statement delimiters). Other statements such as SCAN are not displayed, and if your input vector file contains SCAN statements these will be automatically flattened into a series of vectors before being displayed. If you alter and save the file note that it will **not** convert these flattened vectors back into SCAN statements.

Just below the text editor pane in DFTView® and above the row of command buttons (Section 4.3), additional information will be displayed about the cursor position in an open vector file. The first line will show the vector and cycle number of the currently-selected line, and if the cursor falls on a pin column the name of that pin will also be displayed. Also when the cursor falls on a pin column, a second line of data (labeled “Signal Data”) will show a horizontal representation of the pin state data beginning at the cursor location and reading downwards as shown here.

The pin state value under the cursor will always appear in the white box next to the “Signal Data” label, and the number of characters of pin state data displayed along the row will expand as the window is expanded. However, if you select a line near the end of the file you may see less than a full window-width of pin state data. Pin state data represents what you can see in the currently-selected pin column. If you “smash” or “compress” a vector (Section 5.3), the pin state data will be updated to match. If you quickly want to switch between normal and fully smashed pin state data you can toggle the “Smash Preview” check button near the bottom right of the application window, and the pin state data in the row will be updated immediately.



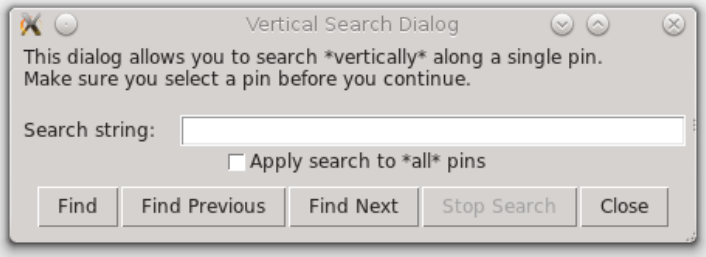
V-mode is an enhanced version of Normal mode, in that all normal mode operations (Search, synchronizing vector line position with waveform cursor position etc.) are still in effect (Section 4). The Edit → Go to Line Number is replaced with two similar operations “Go to Vector” and “Go to Cycle”. In addition extra operations are available via a new specific **V-Mode** menu which appears alongside the normal **Edit** menu:

- **V-Mode (drop-down menu)**
  - **V-Mode → Vertical Search**
  - **V-Mode → Vertical Search/Replace**
  - **V-Mode → Locate Pin/Signal**
  - **V-Mode → Smash**
  - **V-Mode → Compress**
  - **V-Mode → Smash All Repeats**

V-Mode → Compress All Repeats
V-Mode → Load V-mode Format File
V-Mode → Remove V-mode Formatting
V-Mode → Go to Previous Change
V-Mode → Go to Next Change

5.2 Vertical Search

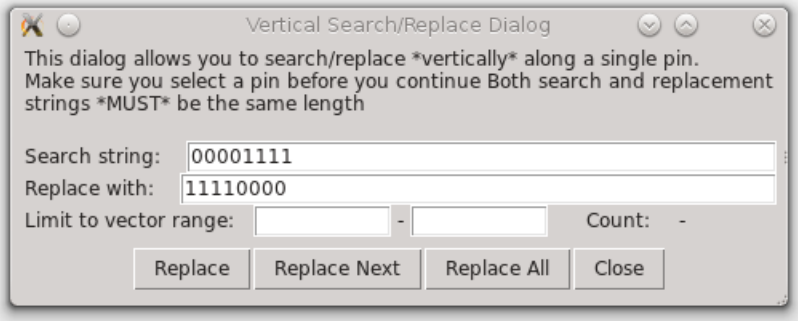
Along with the regular Search option (Section 4.4.2) V-mode also provides additional search behavior for the application. In normal mode, search is performed in a standard "text-editor" fashion, scanning line by line until a match is found. As seen in the extra **Edit** menu options above, both "Vertical Search" and "Vertical Search & Replace" options are available. The Vertical Search operation allows the user to search vertically on any selected column representing a single pin, although you can elect to search all columns (pins) as well. If all pins are being searched each pin will be highlighted in turn as its pin state data is searched for a matching pattern, and because this can be a time-consuming operation it can be interrupted at any time with the "Stop Search" button.



5.3 Vertical Search/Replace

In V-mode you can search for and replace a sequence of state characters on a single pin. With a pin selected you can call up this dialog box and use it to substitute new state sequences on the selected pin. Use the "Limit to vector range" entries if you wish to limit the "Replace All" operation to within the range you specify – if you do not specify a limit the replacement operation will be carried out on ***all*** vectors for the pin you selected. As shown here, when you use the "Replace All" button, the number

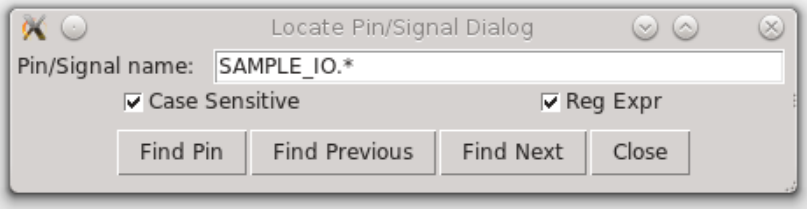
of substitutions performed will be indicated near the bottom right of the dialog box.



Once you have entered your search and replacement strings, click on “Replace” to affect the requested change on the selected column beginning at *your current cursor location and working downwards*. You can then click “Replace Next” to change the next matching sequence, reading downwards. When a vector range limit is set, changes will not occur outside that range even if you click “Replace Next”.

5.4 Locate Pin/Signal

This option allows you to quickly locate a pin or pin group. It will pop up a dialog very similar to that which you’ve already seen for normal Search (Section 4.4.2):

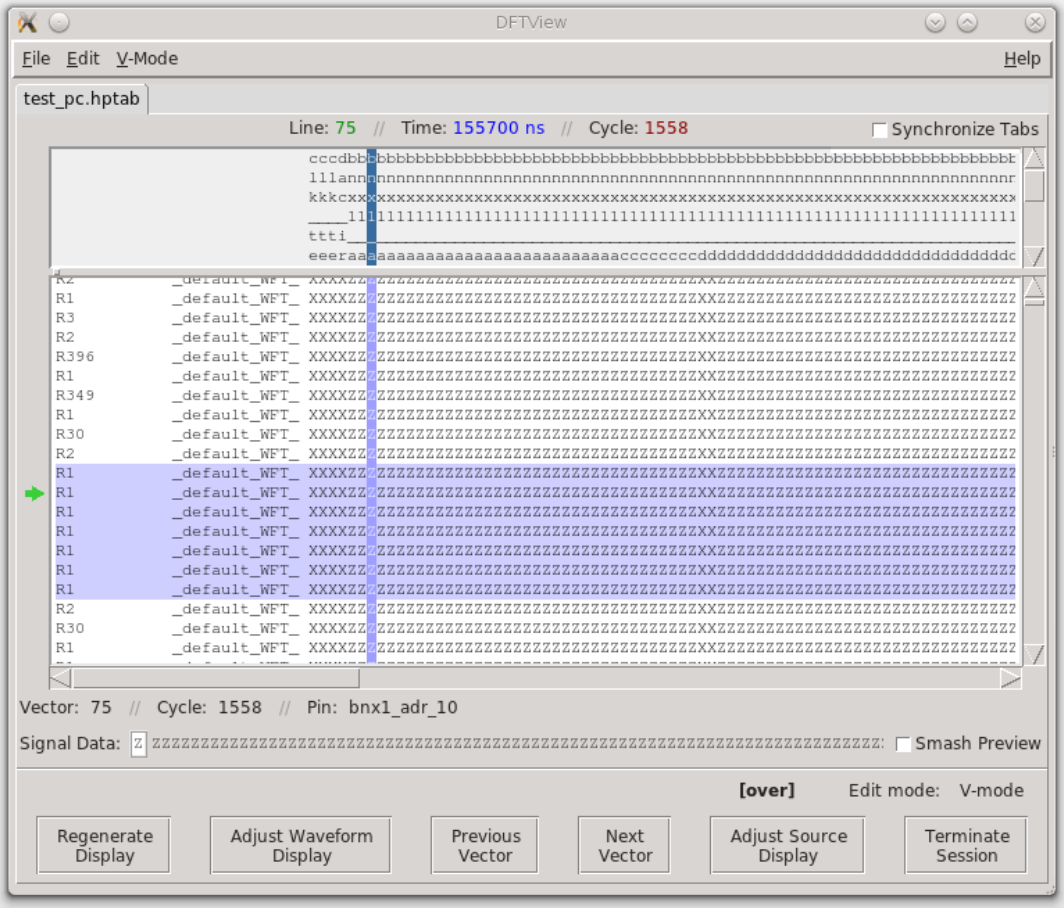


You can search by absolute pin name, or use case sensitivity and/or regular expressions to widen your search. The search is always started from the left-most pin as displayed in DFTView®. If a pin is located the vertical cursor will be moved immediately. Use the “Find Previous” and “Find Next” buttons to search left or right for additional pins matching your search parameters.

5.5 Smash and Compress

The **Edit** menu also provides additional options when a file has been opened in V-mode. If the cursor is sitting on a vector line which has a repeat value > 1, or is inside a loop block (wrapped in SQPG RPTV and SQPG PADDING statements) the “Smash” will be enabled and the arrow cursor to the left of the text pane will change to bright green. Such vectors and loops can be “smashed” (also known as “expanded” or “flattened”) such that each repeated vector is explicitly listed in the source window (similarly for loops where each set of vectors will be explicitly listed). For convenience, a smashed repeat vector or loop will be highlighted in light blue so they can be easily and quickly identified. The companion “Smash all Repeats” will iteratively smash any vector or loops with a repeat count greater than one. Note that for large files this process may take some time to complete. Complementing these “Smash” options the **Edit** menu also provides both a “Compress” and “Compress all Repeats” option.

The “Compress” operation will only be enabled when the cursor is sitting on a previously smashed block or loop. As with the “Smash” option, if the arrow cursor is aligned with such a previously smashed entry it will again change color to green indicating the “Compress” operation is available. The text-editor cursor may be placed anywhere in the smashed block, and selecting this option will replace the block with the original single vector line or loop block Just as you'd expect, the “Compress all Repeats” option will compress all vectors or loops which have been previously smashed. The following screen shot shows a smashed repeat vector:



> ***Tip:*** *When using the "Smash" and "Compress" operations it is possible for the cycle/vector correlation to go out of sync. If the cycle and vector numbers (Section 5.1) both show zeros or otherwise seem to be incorrect, and especially if the "**Regenerate Display**" button is flashing, don't forget to click the "**Regenerate Display**" button to refresh the waveform display and vector numbers (section 4.3.1).*

5.6 Other Operations

Two other useful operations are available in V-mode. The last two Edit menu options, "Go to Previous Change" and "Go to Next Change" provide a convenient way to jump the previous or next pin state

change on a given pin column, without necessarily knowing what the particular changed state will be. This option will also only be enabled if the cursor is sitting on a pin state column.

5.7 Pin Selection and Formatting

While displaying all the signals and their corresponding waveforms from the input file is already extremely useful, V-mode adds another feature to facilitate narrowing down the amount of information you wish to examine – V-mode Formatting.

This is accomplished by way of a pin formatting file which can be loaded into DFTView® via the **V-Mode → Load V-mode format file** menu option, and used to define which signals should be viewed, and in which order. To undo the operation, select **Remove V-mode formatting** from the **V-Mode** menu.

> ***Tip:*** *If pin formatting is applied (i.e. you have already loaded a V-mode format file), you can re-apply this format file after editing it in an external editor, or apply a different format file, by using the same menu option which will now read "Load/Reload V-mode Format File". This will automatically remove the current pin formatting (preserving any changes to the vector file you may have made) and apply the updated pin formatting file in its place.*

5.7.1 Basic File Format

The pin formatting file is itself a very simple INI-style text file. It must at the very least contain a `[display]` section which tells DFTView® which signals to display, *e.g.*:

```
[display]
INPUT[3]
INPUT[2]
INPUT[1]
INPUT[0]
SPACER
CLK_A
CLK_B
```

In this example, four input pins constituting a bus should be displayed, followed by a blank column and

then two clock signals. The SPACER statement can be used as many times as you wish to further separate out signals you wish to view (note all caps are required for this keyword - the lower-case string “spacer” or any mixed-case variant thereof will be interpreted as a signal name). These spaces will appear as blank columns in the vector display (text editor), but there will be no corresponding spaces in the waveform display. The signals themselves will be displayed in the same order as listed in both in the text editor and the waveform viewer. You may put comments in the format file by beginning the line with a # character, and blank lines and spaces are allowed. Section titles such as `[display]` are not case-sensitive, but note that pin/signal names **are**.

You do not need to list every signal in your vector file. For example this can be a very convenient way of displaying only those signals you're interested in, without needing to convert or edit your input file in any way.

You can also list the same signal two or more times for display, but see Section 5.7.5 for some limitations on this feature.

5.7.2 Named Pin Groups

You can also optionally define a pin group via a `[pingroup]` section. The first line in such a section should be the name of the pin group, and subsequent lines should list the signals making up this pin group, in the order you wish to add them. The name of a pin group must not be the same as the name of an individual signal or the pin group will be ignored. The signals can be listed on one line or split across multiple lines and note that *spaces are not allowed* on any of the lines shown below. The following two pin group declarations are equivalent:

```
[pingroup]
name=INPUT[3:0]
signals=INPUT[3],INPUT[2],INPUT[1],INPUT[0]

[pingroup]
name=INPUT[3:0]
signals=INPUT[3],INPUT[2]
```

```
signals=INPUT[1]
signals=INPUT[0]
```

The name of the pin group can then be listed in the `[display]` section and that complete group will be displayed.

You may list the same signal in multiple pin groups and display them, but as with single signals, there are some limitations on displaying them (Sections 5.7.5 and 5.8).

As with single signals, not all pin groups must be displayed – you can declare all of your pin groups as shown here, but then only list a few of them in the `[display]` section.

5.7.3 Single-bit Buses As Pin Groups

When specifying the name of a pin group, you may specify single-bit buses in single-index or dual-index forms. The following two entries are equivalent:

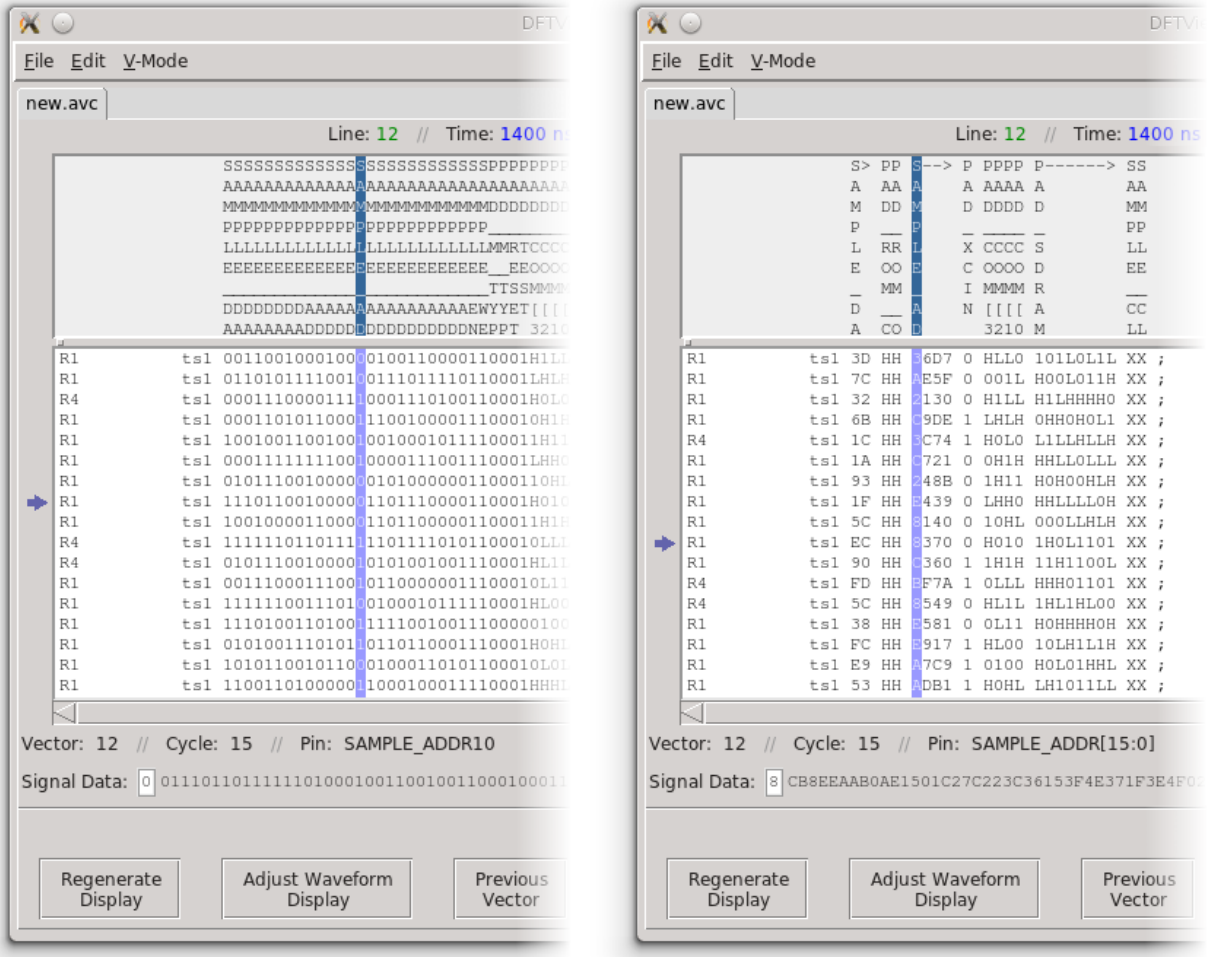
```
name=SIGBUS[0]
name=SIGBUS[0:0]
```

This form of a single-bit bus can be used interchangeably in the `name=` section of a `[pingroup]` and in the `[display]` section. You can define a pin group with a name of `SIGBUS[1:1]` and then reference it in the `[display]` section using the name `SIGBUS[0]`, or vice-versa. Note however that you ***cannot*** use this form in the `signals=` section of a pin group (Section 5.7.2) because this section ***must*** list every signal separately.

5.7.4 Display Radix

Pin groups can be displayed in binary or hexadecimal. The side-by-side screen shot sample on the following page demonstrates a file displayed in DFTView® with V-mode, before and after pin

formatting has been applied. Notice how the hexadecimal display makes it easier to read the state of the selected bus (column).



By default a pin group will be displayed in binary form, and if no formatting option is listed after a signal or pin group in the `[display]` section, the BIN formatting option (case-insensitive) is assumed. When a pin group is displayed in BIN format the Vector/Cycle/Pin information near the bottom of the window will indicate both pingroup and component pin name at the cursor position where applicable. When displayed in HEX (see next paragraph), all four component pin names which make up the single column at the cursor position will be listed in parentheses after the pingroup name.

You may also specify HEX in which case each four pins will be translated in order into the relevant hexadecimal character if possible.

```
[display]
SPACER
CLK
INPUT[3:0]    hex
```

For example, if at a given vector our input file for pins `INPUT[3]`, `INPUT[2]`, `INPUT[1]` and `INPUT[0]` listed the states as 0,1,0,0, then in hex that would be displayed as 4. Likewise for low/high pin states, in this case LHLL. If the four states cannot be combined into a hex character, a '?' character will be displayed instead. So four pin states 01XX or X00X would both be displayed as ? (but will correctly revert to their original states once pin formatting is removed). The only exception is where all four characters are the same 'X' state: here XXXX would be displayed as X. Hexadecimal values may be edited and the change will be retained when pin formatting is removed. Thus changing a 0 to an F which displayed in hex will change the original pin states from 0000 to 1111 or LLLL to HHHH as applicable.

Pin states are interpreted in the order they are listed. To display a bus of four pins in most-significant-bit (MSB) order listed them low to high (*e.g.* `SIG[0:3]`) while for LSB ordering they should be listed high to low (*e.g.* `SIG[3:0]`). In the previous example, the INPUT bus is interpreted in LSB order. Here's one way to display the same bus in both LSB and MSB forms:

```
[pingroup]
name=BUS[7:0]
signals=SIG[7],SIG[6],SIG[5],SIG[4]
signals=SIG[3],SIG[2],SIG[1],SIG[0]

[pingroup]
name=BUS[0:7]
signals=SIG[0],SIG[1],SIG[2],SIG[3]
```

```
signals=SIG[4],SIG[5],SIG[6],SIG[7]

[display]
BUS[7:0]    hex
SPACER
BUS[0:7]    hex
```

5.7.5 Declaring Duplicate Pins

You may list any signal multiple times in the `[display]` section (Section 5.7.1), and it will be repeated as columns within the V-mode source editor in the order it was listed. These repeated signals do not need to be adjacent – they can be listed in any order, as shown in this example, where a clock signal is placed alongside two different buses of interest:

```
[display]
SPACER
CLK_A
LARGE_BUS[127:0]
CONTROLPIN
CLK_A
INPUT[3:0]
```

If your configured waveform display application is Synopsys nWave/Verdi (Section 2.4) you will see a duplicate trace for each duplicate pin. However, if you are using **GTKWave** you will see a trace only for the ***first*** occurrence of that signal. This applies whether the signal is listed standalone or included as part of a pin group.

Even if using Synopsys nWave/Verdi you are further limited to seeing a single bus or set of traces *if you list the same pingroup multiple times* in the `[display]` section (they will, as always, be correctly displayed in your source editor). Since you can display the same pin in different pin groups however, you can simply define a second pingroup with the same makeup as the first, and that will display as a separate bus or set of traces, as shown here:

```
[pingroup]
name=DUPLICATE_A[3:0]
signals=SIG[3],SIG[2],SIG[1],SIG[0]

[pingroup]
name=DUPLICATE_B[3:0]
signals=SIG[3],SIG[2],SIG[1],SIG[0]

[display]
SPACER
DUPLICATE_A[3:0]
DUPLICATE_B[3:0]
```

There is one more important restriction you should be aware of. When displaying multiple pin groups no pin group which shares a pin with another can be displayed with a hexadecimal radix (Section 5.7.4). You must use a binary radix in the [display] section (or no radix, which defaults to binary).

5.8 Editing Columns When Formatted

When pin formatting is applied, you can make changes in the main source editor to the state of any displayed pin at any time point, and these changes will be retained if the pin formatting is subsequently removed (via the **V-Mode → Remove V-mode Formatting** menu option).

It is important to note that if a pin is displayed multiple times (as in the previous example), only changes to the ***first*** occurrence of that pin will be preserved. So in this case if you wish to edit CLK_A in the main source editor (Section 4.2) you must do so to the left-most CLK_A column – edits to any following column representing the same pin will be lost.

Similarly, while you will see separate traces for each duplicated pin entry if using Synopsys nWave/Verdi, these traces are linked to the left-most column in the source editor. Any edits made to that column will be reflected in ***every*** duplicate waveform trace when you perform a “Regenerate

Display" operation (Section 4.3.1), while edits to second or subsequent duplicate columns will have no effect.

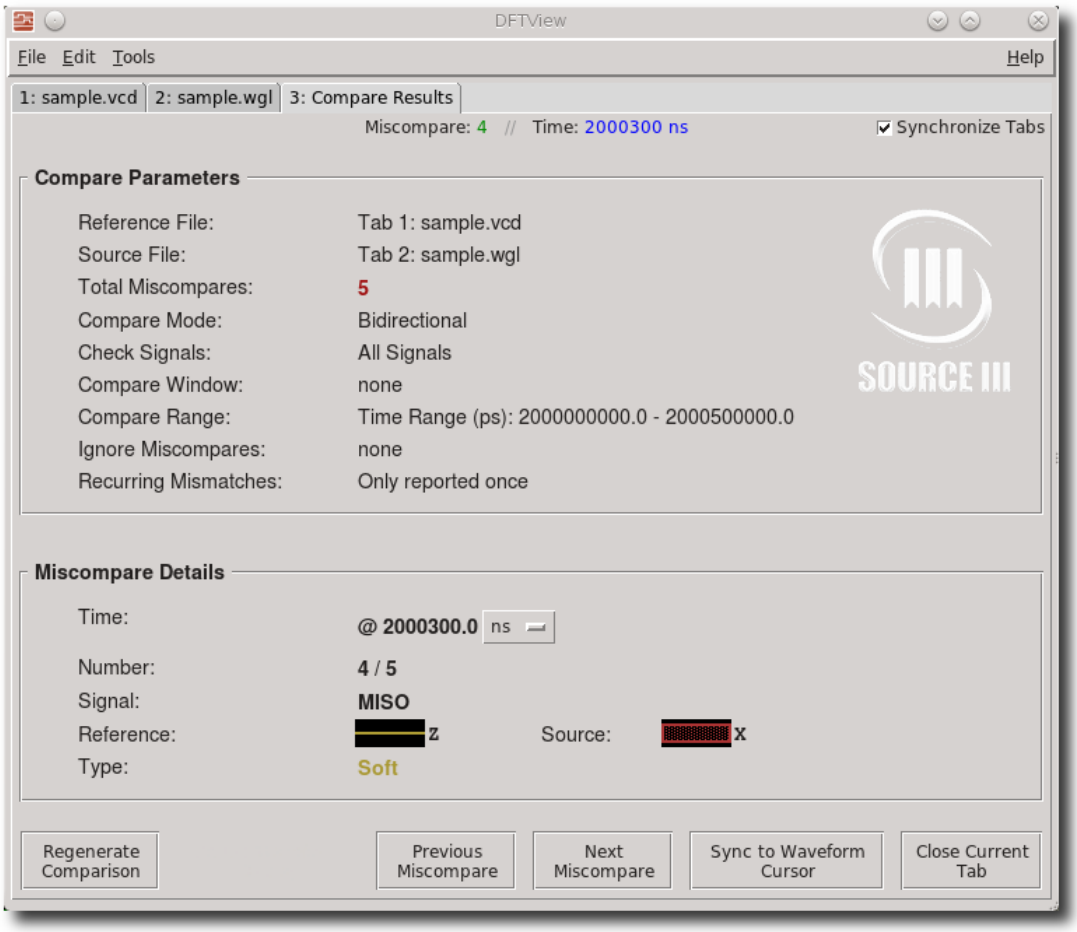
> ***Tip:*** *Editing the state of duplicate signal which is part of a bus further complicates the issue - since buses are typically displayed in the waveform viewer showing their hexadecimal value, the values of EVERY bus which shares that pin will change when you "Regenerate Display". If you are editing duplicate pins and things start to look out of sync, Reapply V-mode Formatting (Section 5.7) to help clear things up.*

6 DFTVIEW® COMPARE MODE

6.1 Overview

DFTView® provides a consistent way to view the waveforms from different file formats. With DFTView® Compare Mode you can open two files representing the same vector set (e.g. an EVCD and a VTRAN®-translated STIL file), view the associated waveforms, and compare the vectors.

This is not a byte-by-byte diff of two text files, but instead a comparison of state and/or transition differences. The results are displayed as an ordered (by time) collection of miscompares (points where the vectors differ) along with a customized waveform representation of them. Each miscompare will be displayed as a peak on an otherwise linear waveform trace (where each signal is represented by a trace).



Unlike a normal source editor/browser window, the results of a Compare are displayed in a custom tab which displays compare parameters, total miscompare count, along with a panel describing details of a selected miscompare (*e.g.* at which time, and on which signal the miscompare occurs). A modified set of controls allows you to navigate through each miscompare in much the same way as you navigate through a source file; you can use the Next/Previous Miscompare buttons to skip from one miscompare to the next, or by clicking on or near a specific miscompare on the waveform display and synchronizing the Compare Results tab to the nearest miscompare.

6.2 Entering Compare Mode

There are two different methods to enter Compare Mode, and in both cases a 'Compare Files' window will be displayed where you can enter/change compare parameters.

In the first method, simply open your two vector files and/or test pattern files as you would normally do (Section 4.4.1.1). As soon as both files have been opened, and the waveforms are displayed, the **Tools → Compare Files** menu option will become enabled. Select this option, or use the “Control-K” keyboard shortcut, and the 'Compare Files' window will be opened.

As a second method, you can also enter Compare Mode by passing the `--compare` command-line option to DFTView®:

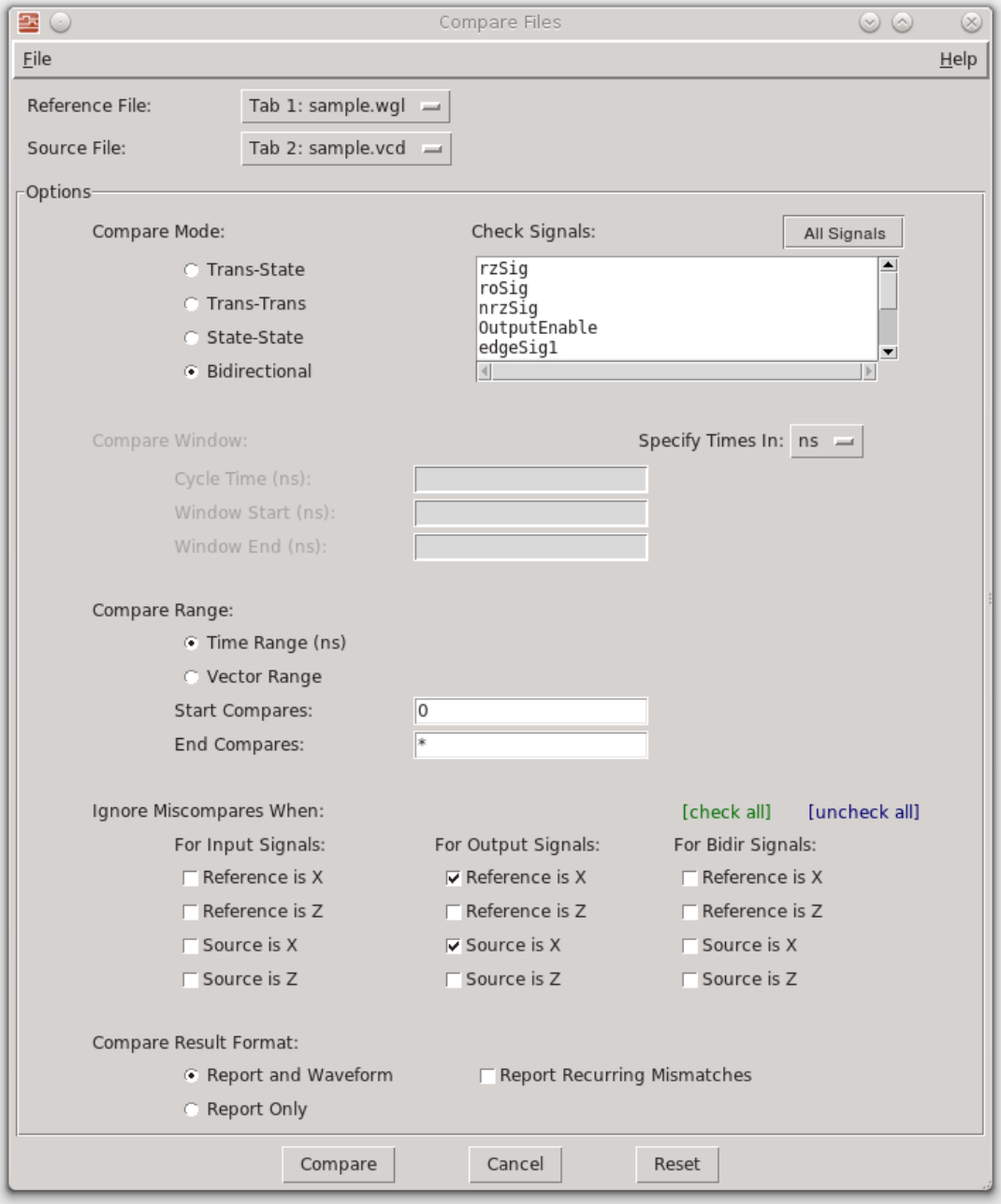
```
DFTView file1.stil file2.vcd --compare
```

Note that you must also pass in two files for DFTView® to open and display or the command will be rejected and DFTView® will not run. The order of the `--compare` option is unimportant (it can be place before, after, or even between the two filenames).

> ***Tip:*** *When comparing an EVCD file to a different format, or two EVCD files against each other, DFTView® must first normalize them by setting signal strengths to 6 or 0 on all transitions, and limiting the number of available states. This process may be time-consuming for large files, and DFTView® will prompt you for confirmation before doing so.*

6.3 Compare Files Window

This window controls all aspects of the Compare operation, from selecting which files to compare (you select from among the available open tabs), which compare mode to use, what time range to examine, which signal states to ignore, and so on.



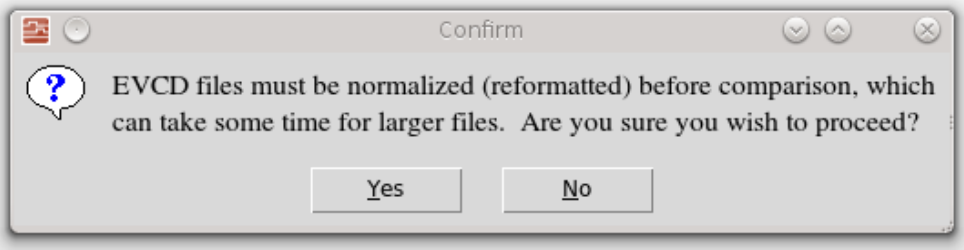
6.3.1 File Selection

DFTView® Compare Mode operates on the waveforms which have already been opened and displayed. When the Compare Files window opens, you can select which tab to use for the reference waveform, and which to use as the source waveform.

> ***Tip:*** *When launching DFTView® Compare Mode via the command-line, the first named file will be preassigned as the Reference and the second will be preassigned as the Source. If you want to change this arrangement just click the 'Reset' button and re-assign them.*

Selecting the Reference and Source files is required, but all other settings on this window are optional and the defaults can be accepted. At this point you can click the 'Compare' button and DFTView® will perform the vector comparison and then report the results of the comparison (Section 6.4).

When an EVCD file is used in a Compare operation, a VCD file must first be generated. You will see this notice when attempting to perform a Compare where at least one file is in EVCD format:


Confirm
EVCD files must be normalized (reformatted) before comparison, which can take some time for larger files. Are you sure you wish to proceed?
Yes
No

You can choose to cancel the operation at this point (in which case no Compare will be performed). If you elect to proceed, the Compare will begin automatically as soon as the VCD intermediate has been generated.

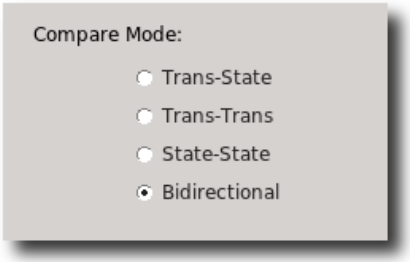
Note also that when a VCD file is generated in this situation, bidirectional signals will ***always*** be split. This retains the signal direction information from the EVCD states at each event.

6.3.2 Compare Options

There are quite a few options which can be used to control how the comparison will be performed. While the default options are very useful, and have been selected to provide what we believe is a very useful starting point when performing a comparison, by changing these options you can easily zero in on a section of interest.

6.3.2.1 Compare Mode

There are four different compare modes available:



a) Trans-State

For every selected pin state transition in the Reference File, the new pin state is verified against the pin state from the Source File at the same time point.

- The comparison is triggered by a pin state transition in the Reference file on a given signal.
- The new pin state in the Reference file is compared against the new pin state at the corresponding time point in the Source file.
- A miscompare is reported when the new pin states do not match and the Ignore State

directives do not apply.

- A miscompare is reported as a "SOFT" miscompare when the new pin state is either X or Z in either the Reference or the Source file and the Ignore State directives do not apply.

b) Trans-Trans

For every selected pin state transition in the Reference File, the Source File is checked to see that the same pin made an identical transition at the same time.

- The comparison is triggered by a pin state transition in the Reference file on a given signal.

- Both the previous and the new pin states in Reference file are compared against the previous and new pin states at the corresponding time point in the Source file.

- A miscompare is reported in two cases. The first case is when either the previous pin states or the new pin states do not match and the Ignore State directives do not apply. The second is when there is no transition in the Source file.

- A miscompare is reported as a "SOFT" miscompare when either the previous or the new pin state is X or Z (in either the Reference or the Source file) and the Ignore State directives do not apply. A miscompare caused by no transition in the Source file is always a "HARD" miscompare.

c) State-State

For every time stamp in the Reference File with a transition on any pin, the states of all selected pins in the Reference File are compared with pin states of the Source File at the same time

point.

d)

- The comparison is triggered by each time stamp in the Reference file where at least one signal has a transition.

- The pin state in the Reference file is compared against the pin state at the corresponding time point in the Source file.

- A miscompare is reported when the pin states do not match and the Ignore State directives do not apply.

- A miscompare is reported as a "SOFT" miscompare when the pin state is either X or Z in either the Reference or the Source file and the Ignore State directives do not apply.

e) Bidirectional

(default mode)

For every time/state data point in either the Reference or the Source files, the other file is checked for an identical time/state data point. This essentially amounts to doing an exclusive-OR of the time/state information in the two files.

- The comparison is triggered by a pin state transition in either the Reference file or the Source file on a given signal.

- The new pin state in the Reference file is compared against the new pin state at the corresponding time point in the Source file.

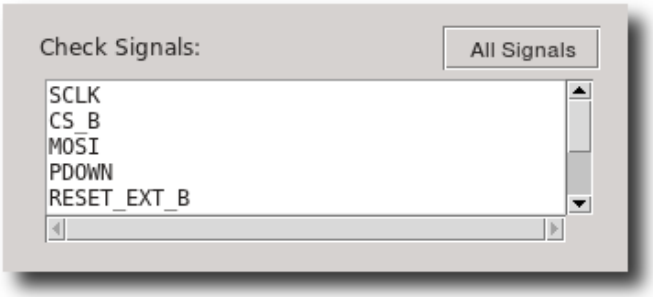
- By default, a miscompare is reported only when the signal is compared, the new pin states do not match and the Ignore State directives do not apply.

- Using the "Report_Recurring_Mismatches" option, a miscompare on a given signal is also reported in the Report File whenever there is a pin state transition in either the Reference file or the Source file on any other signal.

- A miscompare is reported as a "SOFT" miscompare when the new pin state is either X or Z in either the Reference or the Source file and the Ignore State directives do not apply.

6.3.2.2 Check Signals

This lists (one per line) the signals which are to be included in the comparison.



By default this panel will list every detected signal, and the button to the top right will indicate “All Signals”. You can click this button to open the Signal Browser where you can edit which signals are to be included, either by selecting them manually or by choosing one of the preset groups such as “Input Signals Only” or “Output Signals Only”. The Signal Browser is explained in detail in Section 6.3.3.

6.3.2.3 Compare Window

This is applicable only to output and bidir-out signals, and specifies a relative start and stop time outside which all comparisons should be masked – a comparison is skipped if the event time relative to the start of the current cycle is outside the window. The start and stop times are applied to all output and bidir-out signals.

The use of a Compare Window is applicable only when the Reference File and the Source File both are (E)VCD, the direction of signals has been specified by the user (in the case of VCD), and at least one (E)VCD file has separate tracks for bidirectional signals.

6.3.2.4 Compare Range

The Compare Range, specified either in time units or vector numbers, provides an absolute range in which the comparison will be applied. No comparison will be performed either before the lower limit or after the upper limit. By default there are no limits (Start Compares at 0, and End Compares at '*' which signifies the end of the Reference File.

6.3.2.5 Ignore Miscompares When

Miscompares fall into two categories - “Hard” and “Soft”, the meaning of which depends on which Compare Mode (Section 6.3.2.1) is set (see below). Which ever Compare Mode is set however, “Soft” miscompares always involve one or the other states (or before/after states in the case of Trans-Trans) being an X or a Z. Any mismatch between a 1 and a 0 is always considered a “Hard” mismatch, and none of these checkboxes will change how they are displayed.

a) Trans-State

If the new Reference File state and/or the Source File state is X or Z, and the corresponding Ignore Miscompare State is not specified, and the states do not match, this is reported as a "soft mismatch" in the Comparison Result.

If the new Reference File state and/or the Source File state is X or Z, and the corresponding Ignore Miscompare State is specified, and the states do not match, this is treated as a match.

b) Trans-Trans

If the previous Reference File state and/or the previous Source File state is X or Z, and the

corresponding Ignore Miscompare State is not specified, and the states do not match, this is reported as a "soft mismatch" in the Comparison Result.

If the previous Reference File state and/or the previous Source File state is X or Z, and the corresponding Ignore Miscompare State is specified, and the states do not match, this is treated as a match.

If the new Reference File state and/or the new Source File state is X or Z, and the corresponding Ignore Miscompare State is not specified, and the states do not match, this is reported as a "soft mismatch" in the Comparison Results tab. If the new Reference File state and/or the new Source File state is X or Z, and the corresponding Ignore Miscompare State is specified, and the states do not match, this is treated as a match.

c) State-State

If the Reference File state and/or the Source File state is X or Z, and the corresponding Ignore Miscompare State is not specified, and the states do not match, this is reported as a "soft mismatch" in the Comparison Report.

If the Reference File state and/or the Source File state is X or Z, and the corresponding Ignore Miscompare State is specified, and the states do not match, this is treated as a match.

d) Bidirectional

If the Reference File state and/or the Source File state is X or Z, and the corresponding Ignore Miscompare State is not specified, and the states do not match, this is reported as a "soft mismatch" in the Comparison Results tab.

If the Reference File state and/or the Source File state is X or Z, and the corresponding Ignore Miscompare State is specified, and the states do not match, this is treated as a match.

When comparing a VCD with an ATE file (for example the result of a VTRAN® translation) you may

see more soft miscompares than you might expect – specifically where an X occurs in place of a Z or a Z in place of an X. This may also be observed when comparing two files where one has split bidirectional signals and one does not (for example if you have checked the "Split Bidirectional Pins" option (Section 4.4.1.1) when opening one file, but not when opening the other). In this particular case, the compare operation checks the signal's bidir-in state in the file where split bidirs has been enabled. If the state is Z, it uses the bidir-out state for the comparison, otherwise, it uses the bidir-in state for the comparison. The selected state is compared to the single state in the file with combined bidirs. This rule is applied both to previous states and new states.

The “For Bidir Signals” checkboxes are not applied when comparing an EVCD file, since all bidirectional signals are split into input and output traces (Section 6.3.1).

The default Ignore options which DFTView® applies (*i.e.* which Ignore checkboxes are enabled automatically) have been chosen to best reflect cases where an X occurring instead of a Z is to be expected. However if you are seeing a lot of soft miscompares, you can choose to enable more of the Ignore options that are available (12 in all) to narrow down these miscompares to only those which are of interest.

You can use the tags labeled **[check all]** and **[uncheck all]** in this to quickly select or deselect all the ignore miscompare options at once. ***NOTE:*** *We recommend caution when using [check all] since you are telling DFTView® to ignore* ***all*** *“Soft” errors, and this may cause you to miss an important transition or state difference.*

6.3.2.6 Compare Results Format

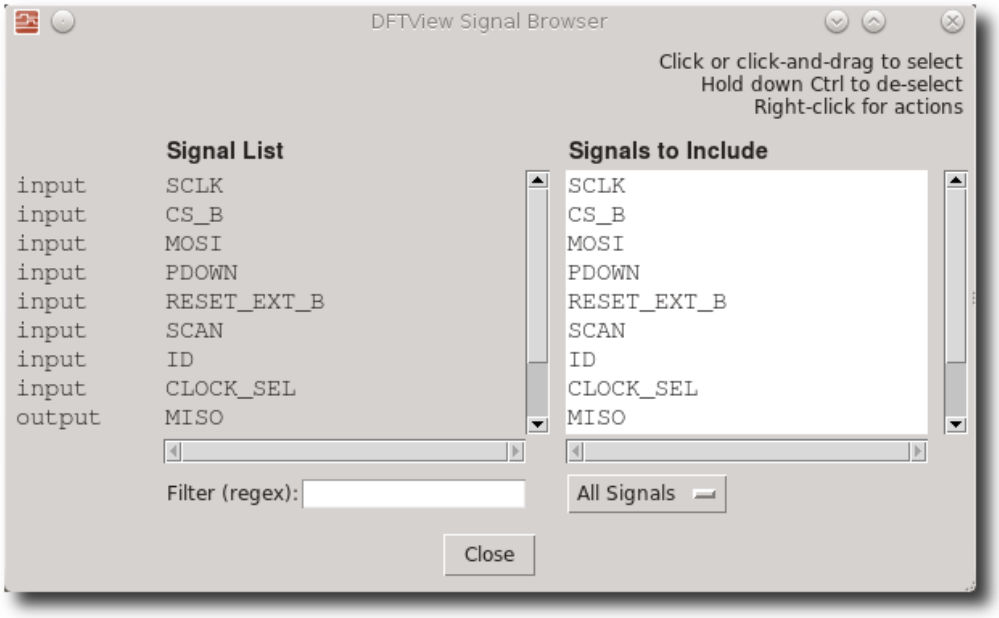
Unless your DFTVIEW_DISPLAY environment variable has been set to **None** (Section 2.4), the default is that any miscompare results will be shown both in report form (in the form of a Compare Results tab (Section 6.4) and a custom waveform view, where Hard errors are shown as 1 in red, and Soft miscompares are shown as X in yellow. This graphical representation of the waveforms makes it easy to visually inspect the resulting “waveforms” for clusters of miscompares or other areas of interest. You can instead elect to show the miscompares in Report form (Results tab) only, and if your

DFTVIEW_DISPLAY environment variable is **None**, this will be the only option available. If no miscompares are reported, no waveform display will open regardless of your DFTVIEW_DISPLAY and Compare Results Format settings.

> *Tip: If you have configured Synopsys nWave or Verdi for your waveform viewer, these colors will be slightly different – green for 1 (hard miscompare) and red for X (soft miscompare). In addition, if you are using a custom novas.rc file your defined Verilog Digital colors for 0, 1 and X states will take preference (in nWave you will find these settings under Preferences → Waveform → Value System → verilog_digital).*

6.3.3 Signal Browser

The Signal Browser lists available signals for comparison. It presents two lists of signals – the one on the left lists all available signals, while the one on the right lists which signals are to be considered when performing the comparison. By default, the latter contains all available signals.



For most file formats which DFTView® supports (Section 1.3) the signal directions are known, and listed alongside the full signal list (left pane). However, when comparing straight VCD to VCD files,

these directions are unknown and in this case you can use the built-in Direction Editor (Section 6.3.3.3) to define signal directions.

6.3.3.1 Signal List

This provides a list of all available signals, read automatically from either Reference or Source file. This list is preferentially read from an ATE file (*e.g.* STIL, WGL, SVF etc.) if one of the two files to be compared is in such a format since all directional information is included. If neither file is ATE file the list of signals will be read by the Reference VCD file (unless one of the pair of files is an EVCD file in which case that will be used). By using this order of preference DFTView® ensures it will have all signal directional information wherever possible.

6.3.3.2 Filter (regex)

This input box allows real-time filtering of the Signal List (Section 6.3.3.1) just above it. As you type in this box the list of signals will be limited to those which include the text you enter. Why should this be useful? You could for example filter the full list of signals to only include those with an 'a' in their name, and then right click this list to “Select All” and then right-click again to “Add to Signal List” to quickly include these in the list of signals to be included in the comparison. These signals would then be added to the 'Signals to Include' pane on the right (Section 6.3.3.4).

In the simplest form, just type a few letters of the signals you're interested in and the list will be updated to only include those signals. If you want more refined filtering you can also use regular expressions (regexes). For example, to include signal names which *begin* with the letter 'S' followed by 'I' you would enter:

```
^si
```

This would include signal names such as “signal2” and “SigOut” but exclude other names such as “AllSignals” (the 'S' in this case is not at the beginning of the name). Note that any filter you use, whether a regex or not, matches on a ***case-insensitive*** basis. Consult an online guide to regular expressions for more detail on this extremely powerful form of pattern matching.

To undo filtering so that all signals are displayed again just erase all characters in this box.

6.3.3.3 Direction Editor

As noted previously, in most cases signal direction information is automatically extracted from any ATE or EVCD file which is included in the comparison. In the case of VCD to VCD files however, the onus is on the user to provide this information. You can right click on a signal or highlight a group of signals and then right-click on the group. In either case you can then define the signal direction to one of *input*, *output*, *bidir*, and for split bidirectional signals, *bidir-in* or *bidir-out*. This added direction information is required when performing a bidirectional comparison (Section 6.3.4). If you don't know this directional information, you can use the “Suggest a direction” option from the contextual menu (displayed when you right-click). This is only a best guess and is **not** guaranteed – use this as a last resort only.

DFTView® will display a warning if any signal directions are listed as 'unknown' when you invoke the 'Compare' button. At this stage you can click “Cancel” to (re-)open the Direction Editor, or “Ok” to proceed – in this case DFTView® will make a best guess for all signals without assigned directions and continue. However, again please note that it is recommended you assign signal directions if possible beforehand.

6.3.3.4 Signals to Include

Much like the Signal List in the left pane (Section 6.3.3.1) this lists signal names, however in this case the list explicitly names which signals should be included in the comparison. Signals *not* listed in this pane will be ignored in the comparison. By default all signals are listed, but as with the Signal List you can right-click one signal or a group of signals, this time to remove them from the list. Unlike the Signal List which cannot be changed (other than filtered – see Section 6.3.3.2) you can also manually type signal names into this pane, as well as pasting them in from an external place where you've copied them – perhaps a separate signal list file.

6.3.3.5 Predefined Groups

As well as the various options for selecting signals to include we have already described, these predefined groups can be used as a convenient shortcut to select only input or output signals, for example. The relevant signals will be listed in the 'Signals to Include' pane just above. You do not (although you can if you wish) have to manually select 'Custom group' if you are going to edit the signal list as described previously – any time you edit, cut or paste the list this will get set for you.

6.3.4 Controls

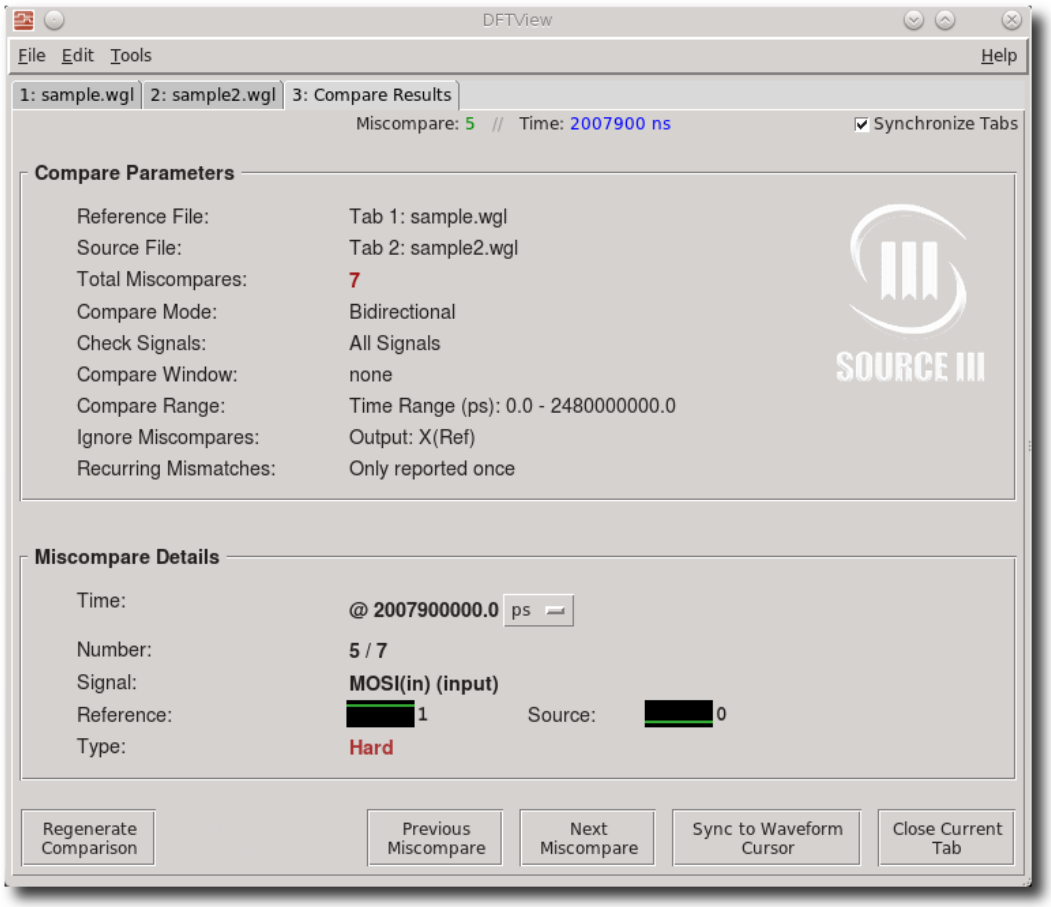
The controls at the bottom of the Compare Files window allow you to begin the Comparison (Compare), Cancel the Compare operation and close the window (Cancel) or Reset the Compare Options including the selected Reference and Source files (Reset).

If you are attempting to compare two VCD files and have not defined signal directions for each signal which is to be included you will be reminded that it's recommended to set all signal directions before the Compare operation begins (Section 6.3.3.3).

6.4 Compare Results Tab

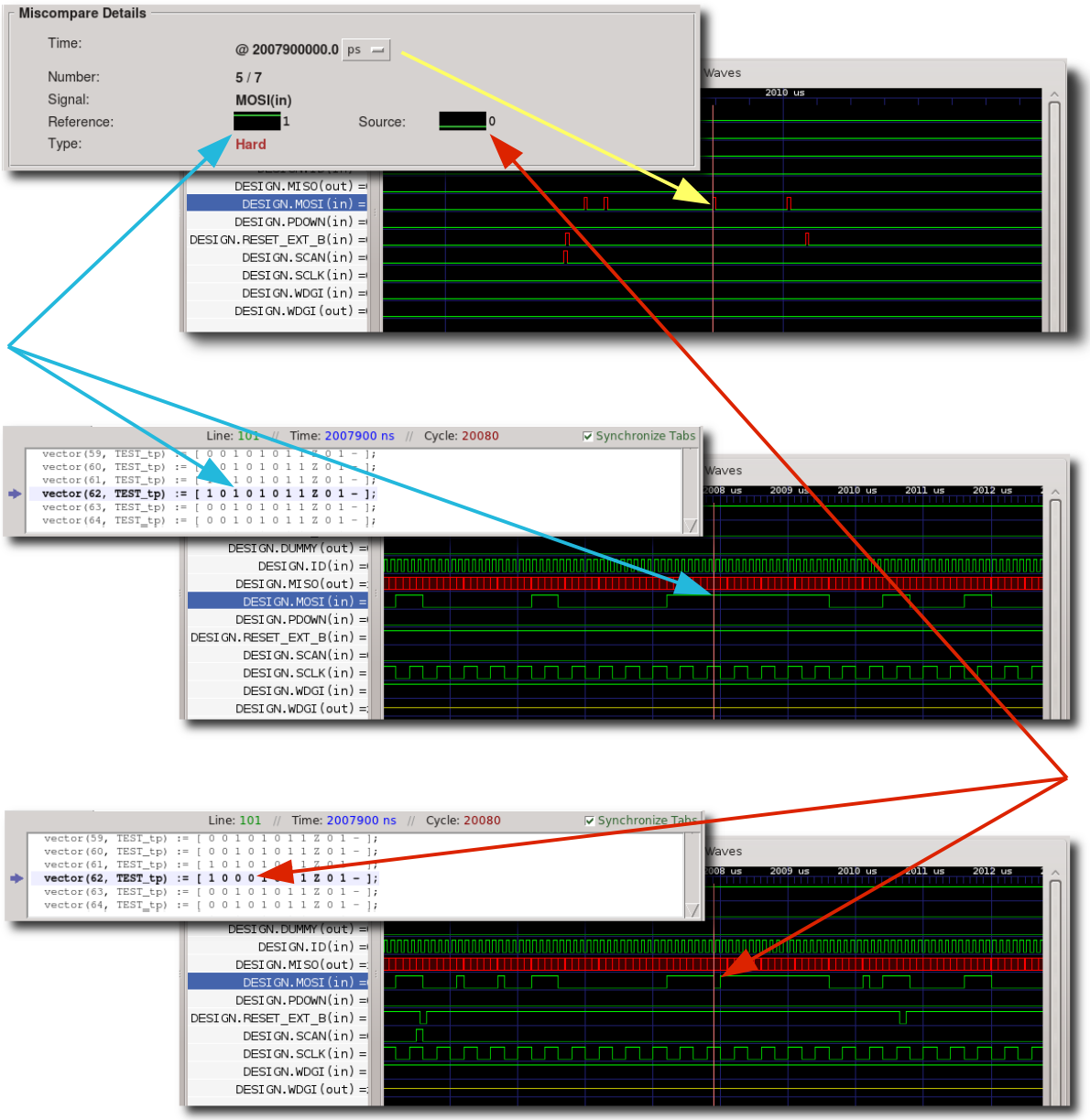
Once the various options have been set, clicking on the 'Compare' button launches the comparison operation. This may take some time to complete for very large files and depending on which options you have selected. While the process is running a new Compare Results tab is opened and displays the current configuration (which compare mode, which signals are included, *etc.*). Once the process has completed, the total number of miscompares detected will be displayed and the very first one will be displayed in the 'Miscompare Details' panel.

The following screen shot shows a typical Results Tab: the upper panel displays the applied parameters for the comparison (which files were compared, which signals were includes, the time range, which states were ignored, *etc.*). The lower panel displays details related to the currently-selected miscompare – showing the two states in graphical and character form (1 and 0), and on which signal and at what time the miscompare occurs.



When a specific miscompare is selected in the results tab, as shown here, the cursor in the Compare Waveform will be placed at the time point at which the miscompare occurs, and in addition the cursor positions of the Reference and Source tabs will also be repositioned to the same spot in both their source editors and waveform windows using Synchronized Navigation (Section 4.2.2).

In addition the named signal or bus at which the miscompare occurs will be highlighted in both compare results window and the waveform viewers. These features combined allow you to very easily trace back to the original files the position at which the miscompare occurs.



This composite image shows details of the Compare Results tab and the Compare Waveform (top) indicating where the miscompare has occurred (yellow arrow). It also shows an excerpt of the designated Reference WGL file text and with associated waveform (center) and Source WGL file text and waveform (bottom).

The blue arrows highlight the state of the MOSI signal at 2007900 ns in the Compare Results Tab and the Reference file & waveform, while the red arrow highlight the same signal and time in the Source file & waveform.

> ***Tip:*** *Unlike other modes where each opened file has its own tab, you can never have more than one Compare Results tab open at a time.*

6.4.1 Regenerate Comparison

Like the **Regenerate Display** button this control allows you to bring up the Compare Files window again, to perhaps modify some options and clicking 'Compare' again, or changing which files to compare and performing the comparison anew. In either case, if you click the 'Compare' button in the Compare Files window, a new comparison will be performed and the information in the Compare Results tab will be updated.

6.4.2 Previous Miscompare

This button provides a means to step sequentially backwards through detected miscompares in the results tab while also moving the waveform displays (and reference and source input tabs) to the corresponding location. The keyboard shortcut **Ctrl-<** (Control and less-than sign) can also be used. In Compare Mode, the **Edit → Previous Vector** menu option is replaced with **Edit → Previous Miscompare**, which performs the same operation.

6.4.3 Next Miscompare

This button provides a means to step sequentially forwards through detected miscompares in the results tab while also moving the waveform displays (and reference and source input tabs) to the corresponding location. The keyboard shortcut **Ctrl->** (Control and greater-than sign) can also be used. In Compare Mode, the **Edit → Next Vector** menu option is replaced with **Edit → Next Miscompare**, which performs the same operation.

6.4.4 Sync to Waveform Cursor

Just as the **Adjust Source Display** button (Section 4.3.5) synchronizes the text file cursor position to the current waveform cursor position, this button causes the results tab to update to the miscompare closest in time to the position of the cursor in the waveform viewer, in either direction. If multiple miscompares occur at the closest time point, the first signal at which a miscompare is detected will be highlighted.

6.4.5 Close Current Tab

The **Close Current Tab** button is used to close the DFTView® Compare Results tab (and associated waveform viewer, if applicable), ending Compare Mode. The original Reference and Source tabs are not closed. You can launch Compare Mode again at any time (provided 2 or more tabs are open) by invoking the **Tools → Compare Files** menu option (Section 6.2).

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